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PREFACE

The present volume, ninth in the series, includes biographical sketches of Fellows of INSA who have distinguished themselves in different fields of Biological and Physical Sciences.

Dr. L. C. Verman was appointed the first Director General of the Indian Standards Institution in 1947. He brought into force standardization in all spheres. He was responsible for introduction of the metric system in weights and measures in the country.

Professor K. C. Mukherjee, was a dedicated Psychologist and an Educationist. In his professional career, Professor Mukherjee achieved the distinction of becoming Professor & Head of the Dept. of Philosophy and Psychology in the Dacca University.

Professors S. C. Chatterjee, L. Rama Rao, M. S. Krishnan, and A. G. Jhingran were reputed geologists. Professor S. C. Chatterjee was a member of several Geographical and Geological Societies of India. He was Professor Emeritus at VikramU niversity where he was responsible for building up the School of Studies in Geology. Professor L. Rama Rao had a deep interest in the study of rocks and carried out research at Geology Department, Central College, Bangalore as Head of the Deptt. Dr. M. S. Krishnan held several prestigious positions including that of Director of the Geological Survey of India. He was also a teacher of geology. Professor Jhingran retired as the Director General of the Geological Survey of India. He was responsible for the creation of the Department of Geology in the University of Delhi.

Professors A. K. Gayen and R. P. Paranjpye were eminent mathematicians. Professor Gayen was a Senior Professor in the Maths. Department of I.I.T., Kharagpur. He made significant contributions in the field of applied statistics. Professor Paranjpye played various roles like Principal, Minister,Vice-Chancellor and India's High Commissioner.

Dr. Basudeva Narayana was a distinguished physiologist of India. Dr. C. C. Calder and Professor S. M. Sircar were eminent botanists. Dr. Calder was Curator of the Royal Botanical Garden, Calcutta and made significant contributions on the drug plant, *Cinchona*. Professor S. M. Sircar was Head of the Department of Botany, University of Calcutta and later Director of Bose Institute, Calcutta. Professor Vishwa Nath was an eminent zoologist and made significant contributions on animal cytology and won several honours including that of the Indian National Science Academy. He was a reputed Plant Physiologist and internationally known for his contributions on vernalization and transport of photosynthates.

In the field of Chemistry, this volume includes pioneers like Dr. K. R. Krishnaswami, Professor R. P. Mitra, Dr. Atma Ram, Professors J. N. Ray, P. C. Guha and G. J. Fowler. Dr. K. R. Krishnaswami was responsible for proliferation

of sandalwood industries in Mysore. Professor Mitra promoted research in electrochemistry of crystals and mica and other minerals at Delhi University. Dr. Atma Ram worked in the areas of photochemistry and held several important positions like that of Director General of CSIR and President of the Indian National Science Academy. He was a reputed scientist and administrator. Professor J. N. Ray built a strong school of research in organic chemistry at Punjab University, Lahore. Professor P. C. Guha held the Chair of organic chemistry in Indian Institute of Science, Bangalore and worked in the fields of stereochemistry, heterocyclic compounds and others. Professor Fowler was Professor of Applied Chemistry and Professor of Biochemistry at Indian Institute of Science, Bangalore and was a winner of several honours. He contributed a great deal to science and practice of Sewage Management.

On behalf of the Academy, I express my sincere thanks to Dr. G. S. Venkataraman and Professor A. N. Mitra, the Editors of Publication for bringing out this volume. I am equally thankful to all the contributors who were directly or indirectly associated with these great Men of Science.

I record my appreciation to Dr. M. Dhara, Shri J. Saketharaman (on lien) and to all the members of the Editorial staff of the Academy for their valuable co-operation and assistance during the preparation and production of this volume.

A. K. SHARMA
President

December 1, 1984.

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Gilbert J. Fowler

GILBERT JOHN FOWLER

(1868–1953)

Foundation Fellow 1935

Gilbert John Fowler was born on January 23, 1868, in Paris, France. He was the son of Robert John and Priscilla (Alleston) Fowler.

Education and Academic Career

Fowler was educated in Sidcot School, Somerset, and Owens College, Victoria University, Manchester, and University of Heidelberg. He took his B.Sc. degree in 1886 and was awarded the Dalton Prize for his research on silver suboxide in 1887. He took his M.Sc. degree in 1889.

Young Fowler's scientific outlook and attitude were, as he once told one of us (S. C. P.) in the course of conversation, greatly influenced by the delightful lectures of the famous biologist T. H. Huxley, and the eminent chemist, Sir Henry Roscoe. Fowler also studied iron and steel industry in Cleveland, District of Yorkshire and metallurgy in Freiberg, in the Harz District, and in the University, and in the University of Sheffield during vacations. In 1904, he was awarded the D.Sc. degree by the University of Heidelberg on a thesis on *purification of sewage*.

Marriage

Dr Fowler married Miss Amy H. Scott in April 1900. They had two sons. Their married life was largely happy and complete.

Appointments held in England

Fowler was appointed Demonstrator in Chemistry in Owens College, and Chemistry and Physics Tutor in Dalton Hall, 1888–96. In 1892, he became assistant Lecturer in Metallurgy in Owens College; and in 1893; he was examiner in chemistry, Union of Lancashire and Cheshire Institutes.

In 1896, Fowler was appointed as Chemist and Bacteriological Assistant to the Rivers Committee, Manchester City Council. Later in 1899, he was made Superintendent and Chemist, Manchester Corporation Sewage works; and in 1904, he became Consulting Chemist to the Rivers Committee. In the same year he was appointed Lecturer in Sanitary Chemistry, Public Health Department, University of Manchester.

In 1912, Dr Fowler was appointed Lecturer and Examiner in Bacteriological Chemistry and Director of the Frankland Laboratory; and in April 1914, at Manchester, he and his associates, E. Arden and W. T. Lockett, developed the activated sludge process of sewage treatment and in the science of sanitation.

Dr Fowler did much consulting work in the England, Egypt, Shanghai, Hong Kong, Africa, Malaya, India, China, Canada and U.S.A. resulting from his pioneer development of the activated sludge method of sewage treatment.

Appointments held in India

From 1906, Dr Fowler was periodically invited by the Municipalities or Corporations of Calcutta, Bombay and Madras to advise them on problems of sewage treatment and admission of trade effluents into municipal sewers. In 1916, he was invited by the authorities of Indian Institute of Science, Bangalore, to become Professor of Applied Chemistry at the Institute. In 1921, he was appointed as the first Professor of Biochemistry at the Indian Institute of Science, Bangalore. It was at this Institute that the first Chair of Biochemistry in India and in the East was created. Professor Fowler retired from the Indian Institute of Science, Bangalore, in 1924.

Even after his retirement from the Institute, Professor Fowler continued to take keen interest in the work of the Department of Biochemistry, particularly on sewage, activated sludge, waste disposal, biochemistry of soil processes and agriculture. One of us (SCP) was associated with Professor Fowler from December 9, 1935 until his last days who passed away on March 21, 1953.

In 1926, Professor Fowler was invited by the Harcourt Butler Technological Institute, Kanpur, to become the Officiating Head of the Research Department at that Institute, of which he became the Principal for two years, 1927–29. After his return from Kanpur, Professor and Mrs Fowler took up permanent residence in the Central Hotel in Bangalore. They were there till the end of Professor Fowler's life, except for periods when he was away in connection with his professional work.

Professor Fowler was invited by the Patna University to give a course of lectures as Sakhraj Ray Reader in Natural Science at that University in 1931–32. He chose as his subject "The Biochemistry of Nitrogen Conservation", since the main objective of his scientific and professional career was to solve the problem of satisfactory utilization of nitrogenous waste material. His scientific philosophy or motto was : "Nitrogen conservation, it will be seen, is a major factor in the world's prosperity; indeed, Nitrogen thus conserved, together with the energy, mental and physical, liberated by an adequate food supply, is a real measure of the Wealth of Nation."

Honours

He was a Fellow of the Royal Institute of Chemistry, 1897; Examiner in Biological Chemistry, 1910–14; and Member of the Council, 1914–16. He was also the Honorary Secretary, Advisory Committee for India, 1921–51. He was Fellow of the Chemical Society of England; Fellow of the Royal Sanitary institute (now the Royal Society of Health); Fellow of National Institute of Sciences, India (now the Indian

National Science Academy); Honorary Member of Manchester Literary and Philosophical Society.

He was President of the Chemistry Section of the Indian Science Congress in 1918, London Chemical Society in 1927, and the Society of Biological Chemists, India, 1947–49. He was member of Industrial Research Council of the Government of India, 1937–39. He was also a consultant to the Government of India and various State Governments and Examiner for the various Indian Universities. He was Technical Representative of Messrs Activated Sludge Limited, London, for India and the East from 1925 until his death, and Consulting Chemist for Vinegar Production, Cross and Blackwell Ltd.

During 1925–53, Fowler was responsible for the installation of about a dozen activated sludge plants of different sizes in different parts of India. The largest of these plants was put up in 1938 at the Government Gun and Shell Factory, Cossipore, near Calcutta with which one of us (SCP) was closely associated. It happened that under the working conditions of this new plant, a mechanism in the process of sewage purification was also discovered, which was later worked out at Bangalore in all its details for the benefit of sanitary science and technology.

During 1938–42, Dr Fowler was away at Madras where he stayed on to impress upon the authorities of the Corporation of Madras on the efficiency and value of the activated sludge process of sewage treatment and to persuade the authorities to put up an activated sludge plant for the treatment of sewage of Madras, and also of Madurai, which was a growing city in Madras State (Tamil Nadu). However, he did not succeed in persuading the authorities at Madras or at Madurai to put up an activated sludge plant. Dr Fowler returned to Bangalore in 1942 and continued to live in the Central Hotel until the day of his death on March 21, 1953.

Scientific Work

As a lecturer in the University of Manchester and Consulting Chemist to the Rivers Committee of Manchester Corporation from 1896 to 1916, he had the opportunity of acquiring deep knowledge and wide experience in sanitary chemistry and he became the leading sanitary chemist of his time. During this period (1896–1916), he was responsible for the treatment of sewage and trade effluents of Manchester. He won international reputation when he and his associates, E. Ardern and W. T. Lockett, developed at Manchester in 1914 the activated sludge process.

On problems of sewage disposal Dr Fowler was consulted by the cities of New York, Cairo, Shanghai and Hong Kong and by the Government of Federated Malay States. He became a well-known expert in the field of waste water treatment.

One of the important lines of work in the Department of Biochemistry at the Indian Institute of Science, Bangalore from the time of Dr Fowler's association with it was naturally concerned with the scientific control of water supply and of sewage and refuse disposal in all its aspects, including its relation to agriculture.

A visit to the Rothamsted Experimental Station, England, during his leave period in 1921 enabled Dr Fowler to become acquainted with the so-called ADCO Process

(Agricultural Development Company Process) of preparation of organic manure. He returned to India with great interest in the production of compost which later became one of the leading manurial activities of the Country. Many students of the Biochemistry Department at the Indian Institute of Science have taken an important part in this work.

Dr Fowler applied the principle of the activated sludge process to the production of compost under aerobic conditions or "activated compost", as he termed it. He was continuously interested in activated sludge, in compost and in other aspects of recovery of nitrogen from waste materials for soil fertilization and crop production. In scientific articles, in lectures and addresses, he developed and enlarged his most favourite theme of nitrogen conservation.

In 1922, Dr Fowler designed and set up an activated sludge plant (alongwith septic tanks and a sewage farm for comparative study) at the Indian Institute of Science. This plant, which dealt with the sewage from the Institute campus of about 400 persons, also served as a useful experimental installation for the study of the mechanism of the activated sludge process. In addition to being an experimental set up, it was also a model plant for providing practical instruction and experience to the students of engineering and medical colleges and other institutions and persons interested in public health and preventive medicine in different parts of India, who periodically visited and studied the operation of this sewage purification plant and other treatment systems. The facility of this activated sludge plant at the Institute is not available now. It should be pointed out that the activated sludge plant proved useful not only in understanding the mechanism of the activated sludge process but also in elucidating the biological principle of aerobic purification of sewage in general and microbiological oxidation of organic matter in waters and soils. Dr Fowler endeavoured to awaken in his students an enduring interest in the biochemistry of life-processes and in harnessing "the forces of biotic energy in the service of man."

Contributions to the Science and Practice of Sewage Management

Dr Fowler played a leading part in the practical development of the activated sludge process of sewage treatment which indeed is a continuing chapter in environmental science and technology. But his theories of the activated sludge process *"can be referred entirely to bacterial activity."* He described it as *"a process of intensive bacterial oxidation, consisting broadly of three operations : a clotting or clarifying action, a rapid carbon oxidation, and finally nitrification."* He added that it was not *"necessary to push clarification to the point of nitrification in order continuously to obtain stable effluents."* He pointed out, however, that the mechanical and absorptive effect of a large mass of flocculent material must greatly assist clarification (A. J. Martin, *The Activated Sludge Process,* Macdonald and Evans, London, 1927, p. 131).

But later investigations by others did not confirm the view of Professor Fowler that the activated sludge process could be referred entirely to bacterial activity. They have collected more convincing evidence on the nature and extent of microbiological activity in the activated sludge process.

According to Dr Fowler, the relatively high nitrogen content of activated sludge with reference to other sewage sludges was due to the nitrogen fixing bacteria in the activated sludge tank which idea though convincing is perhaps yet to be confirmed by later investigations. The mechanism of concentration of nitrogen in activated sludge was later studied by other investigators who showed that certain protozoa in the activated sludge utilize the organic nitrogen, including the amino acids, in the sewage and thus concentrate and contribute to the relatively high nitrogen content of activated sludge.

Fowler's observations that oxygen in the nitrate in the purified or oxidized sewage effluent could be useful in the oxidation of organic matter in sewage led to later demonstrations of the necessity of dissolved oxygen for microbiological oxidation.

But the advent of the activated sludge process was, in the historical perspective, a momentous development. Until this development, sewage treatment was not regarded as a scientific discipline or subject, because the earlier methods of sewage disposal or treatment, like the dilution method (discharge of sewage into a body of water), treatment of sewage on an extensive area of land, lagooning or oxidation pond, chemical precipitation, or treatment on special beds or filters, e.g., the "contact bed", trickling or percolating filters, were rather empirical and did not evoke any interest as in a scientific reproducible process or as in a truly scientific reproducible process or as in a truly scientific principle. The development of the activated sludge process gave a new dimension to the whole field of sewage treatment in which a wider circle of scientists—chemists, microbiologists, engineers and others became interested in the investigation of the activated sludge process.

It is, however, deeply interesting that simple aeration of successive portions of raw sewage, a grossly polluted water or a polluting liquid or a manurial suspension and solution, gives rise to a material having a most remarkable purifying power which has been greatly appreciated and utilized for better sanitation and public health in the larger cities of the world. Consider, for instance, the conditions around a large city in the United States and the effective improvement by an activated sludge plant as described by Dr Fowler. He observed : "North of Chicago lies Milwaukee whose sewage at one time poured untreated into Lake Michigan fouling the water supply of this city and its neighbours. Now an immense activated sludge plant converts all this impurity into clear effluent and into fertilizer valued at £100,000 per annum. The sludge which used to defile the bright waters of the Lake now reappears as wheat on the wide acres of western prairies or as smooth rich turf on countless golf greens" (G. J. Fowler, *An Introduction to the Biochemistry of Nitrogen Conservation,* Edward Arnold and Co., London, 1934, p. 242.)

Referring to a smaller activated sludge plant at the Government Rifle Factor at Ishapore, near Calcutta, Dr Fowler observed that fish were grown in a tank on the estate of the Factory, into which for some time the effluent from that activated sludge plant had been discharged and that the fish had "grown freely and healthily under these conditions, and were stated by European consumers to be of excellent quality" (G. J. Fowler, *An Introduction to the Biochemistry of Nitrogen Conservation,* Edward Arnold and Co., London, 1934, p. 244). Dr Fowler was one of those few who conceived that the changes proceeding in fertile soil are similar to the changes

occurring in sewage during purification—a concept of great fundamental activated sludge plant put up by Fowler in 1922 at the Indian Institute of Science, Bangalore, as indicated, proved very valuable not only for elucidating the principle of the process of purification but also in demonstrating the value of the sludge as an organic fertilizer or manure and as a feed supplement for poultry.

Here then lies the major contribution of Dr Fowler in the development of the activated sludge process, the significance of which has been increasingly realised during the last 66 years as a compact and efficient system of treatment of sewage and other organic waste waters and the impact it has had on soil science.

Services to Science

In addition to being a leading sanitary chemist of his time, Dr Fowler was also a great educationist, a popular speaker and writer. By his speeches and writings he, more than any of his contemporaries, awakened great public interest in the subjects of sewage disposal and sanitation and production of wealth from waste. His popular articles are characterized by a keen sense of humour, breadth of view and a lucid style. Even as he dealt with scientific and technical aspects he had his own way and style of putting across his ideas in a most interesting and memorable manner. For instance, in explaining the behaviour of polycellular and polyenzymic organisms he wrote in his monograph on *An Introduction to the Biochemistry of Nitrogen Conservation,* 1934 (Edward Arnold and Co., p. 23) :

"The more highly organized plants and animals may be termed poly-cellular and monoenzymic, in the sense that different cells exercise quite different functions, and excrete entirely different enzymes, the whole organism being, as it were, a controlled community whose members were exercising different functions working in harmony with one another. A simple illustration of what is meant by this description is afforded by an experiment which can be made on any dog and to which no objection can be taken either by the dog or his friends. If a dog is given a piece of toast he will chew it carefully and at some length before he swallows it; if he is given a piece of meat, on the other hand, he will swallow it instantly without mastication. The dog presumably has no knowledge of biochemistry, but in fact he behaves in accordance with its laws, since the enzyme which dissolves the starch and carbohydrate of the toast is contained in his saliva, while the *pepsin* which breaks down the albuminoid of the meat is particularly active in his stomach, so much so that he has found preliminary mastication to be unnecessary."

Finally, it may be stated that for over 57 years, from 1896 to 1953, Dr Fowler ceaselessly worked and wrote on purification of water, treatment and utilization of sewage and other wastes in agriculture and thus roused the interest of the public in environmental sanitation and production of wealth from waste. Professor Gilbert J. Fowler will, therefore, be remembered as a great figure in environmental science and technology and its applications for the benefit of mankind.

S. C. Pillai
Kasi Viswanath

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E. C. Calder

CHARLES CUMMING CALDER

(1884–1962)

Foundation Fellow 1935

CHARLES CUMMING CALDER was born in Presley, Parish of Edinkille, Morayshire in North Scotland on December 3, 1884. His father, George Calder, was a farmer who belonged to a distinguished Protestant family of remarkable attainments. His eldest brother Sir William Moir Calder, a scholar in Classics, was Professor of Greek in the University of Edinburgh. His younger brother, a graduate of the Aberdeen University, in his twenty-fourth year fell at the battle of Loos in the first World War. One of his two sisters, was married to Mr William McRae, an eminent mycologist in the Indian Agricultural Service.

EDUCATION AND CAREER

Charles had his elementary education at Logie School, a fine old parish school in Scotland. He then proceeded to Robert Gordon's College, Aberdeen, and later at the University of Aberdeen, he received the B.Sc. degree in Agriculture in 1908. After gaining a *Carnegie Scholarship,* Calder took up a post-graduate course in Botany at the University of Berlin.

He returned to Scotland in 1909 and joined as a Senior Assistant to Dr James W. H. Trail, Professor of Botany at the University of Aberdeen, where he remained till his appointment as curator of the Herbarium of the Royal Botanic Garden, Calcutta.

AT THE ROYAL BOTANICAL GARDEN, CALCUTTA

Sir David Prain, then Director of the Royal Botanic Gardens at Kew, on being asked by the Secretary of State for India in Council, recommended young Calder for appointment to the post of Curator of the Royal Botanical Garden, Calcutta. This was a prestigious post; his immediate predecessor was Sir William Wright Smith, later Professor of Botany at the University of Edinburgh.

Calder arrived in India on March 22, 1912 and on the following day joined as Curator of the Harbarium under Col. Gage. As Curator of the Harbarium, Calder often acted as Superintendent of the Garden and Director of Botanical Survey of India on several occasions, in the absence of Col. Gage.

His services were also lent by the Secretary of the State for India to the Intelligence Branch of the Admiralty in July 1916. This was during World War I. Again

during November, 1918—April, 1919, he was on military duty with the Mesopotamia Expeditionary Force, Baghdad, as 'Acting Captain'.

Calder succeeded Col. Gage as acting Superintendent of the Garden and Director of Botanical Survey of India on January 3, 1923, and finally, on May 2, 1925, when Col. Gage formally retired from service, Calder was confirmed in the posts. Besides the Botanic Garden and Herbarium at Sibpur, he had under his control the Lloyd Botanic Garden at Darjeeling, three other Gardens in Calcutta (namely, Eden, Curzon and the Dalhousie Square), and the Cinchona Department of Bengal. The Cinchona Department had two plantations and a quinine factory, which was the source of supply of quinine to the Hospitals and Government Institutions not only in Bengal but throughout northern India. As Director of the Botanical Survey of India and as the Superintendent of the Garden, Calder was also responsible for the activities of the Survey which were carried out at the Herbarium at Sibpur. The Industrial Section of the Indian Museum dealt with economic plants. The Cinchona plantations of the India Government in Burma were also under his jurisdiction. The distribution and safe keeping of the quinine stocks in the country, were in his hands, as Advisor to the Government of India in all matters relating to Cinchona and Quinine.

The great demand for quinine boosted efforts in cultivation of Cinchona, but following World War I, a policy of general retirement had adverse effects on the botanical generally the scientific activity of the Department.

Calder and Cinchona

It is evident that during his career, Calder had to spend a great deal of his time in routine—administrative work, particularly that connected with promotion and utilization of Cinchona. In 1923, when Mr. I. H. Burkill sought Calder's collaboration to work out his collection of plants from Abor, Calder regretted his inability saying, "....my days and nights are being taken away by Cinchona business....." Thus, Calder's scientific publications are rather few. He wrote one short paper each on *Oxalis* and *Vernonia,* a brief account of the vegetation of India, and along with Narayanaswami and Ramaswami, he listed the genera and species of Indian phanerogames not included in Hooker's '*Flora of British India.*'

At the instance of Col. J. A. Sinton, Director, Malaria Survey, he also wrote, jointly with K. Biswas, the '*Handbook of Common Water and Marsh Plants of India.*'

Apart from field collections made while on Cinchona duty, during 1913–14, Calder worked along with Ramaswami on the flora of Travancore. During 1918–19, while on military duty in Mesopotamia, he made a collection of plants around Baghdad, Baiji Shergat, Mosul and Basra. He, however, did not publish anything on these collections. His plants from Iraq are in the British Museum, London, and in Central National Herbarium, Calcutta.

Within his limitations, Calder did try to revive the botanical activities of the Cinchona Department. Like his predecessor Col. Gage, he also moved the Government for separation of the Cinchona Department and transfer of the Botanical Garden to the care of the Government of India, but these efforts did not meet with success. When the recruitment of European gardeners in Indian Service ceased,

and to meet the demand for trained horticulturists, Calder, in July 1925, submitted to the Government of Bengal an elaborate scheme for horticultural training. He suggested a three year training course in horticulture at the Calcutta Botanical Garden on the lines of the Gardens at Kew and Edinburgh. This, however, did not materialize due to financial stringency.

Honours

Calder was associated with several learned societies and institutions in India and abroad. A fellow of the Linnean Society and Royal Horticultural Society, London, Calder was a Foundation Fellow of the National Institute of Sciences of India (now the Indian National Science Academy). He was also a Member of the Council of the Royal Asiatic Society, Bengal and a trustee of the Indian Museum. He presided over the Botany Section of the First Session of the Indian Science Congress held in Calcutta in January, 1914. When the Botany Department of Calcutta University was established in 1918, at the instance of Sir Ashutosh Mukherjee, then Vice-Chancellor of the University, Calder undertook, from time to time, postgraduate teaching at the University.

Family

In 1913, while in Calcutta, Calder married Lilian Margaret Reid, daughter of James Reid, a draper in Aberdeen, and by the marriage had a son and a daughter. His son, who was born in Darjeeling on the September 25, 1914, was sent to Aberdeen for his education. There he took his M.A. in 1936, and LL.B. in 1940 and later became a practising solicitor.

Calder was the first non-medical man to be appointed Superintendent of the Royal Botanic Garden, Calcutta and Director, Botanical Survey of India in succession to a galaxy of famous medical officers. It is also interesting that three of his predecessors, Sir George King, Sir David Prain and Col. A. T. Gage were all from Scotland and were alumni of the Aberdeen University.

After 25 years of service, on October 29, 1937, Calder left for Aberdeen on leave preparatory to retirement handling over the office of the superintendent of the Royal Botanic Garden at Calcutta to Dr K. Biswas. The Office of the Director of the Botanical Survey of India was kept in abeyance. He formally retired from service on the December 3, 1939. With his retirement came an end to a long and distinguished service in the cause of Botany and allied sciences in India

During World War II, he served as Farm Labour Organiser with the Agricultural authorities in Aberdeen. He continued to live in Aberdeen until his death on the April 18, 1962

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S. K. JAIN
R. L. MITRA

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PRAPHULLA CHANDRA GUHA

(1894–1962)

Elected F.N.I. 1935

Birth and Education

Praphulla Chandra Guha was born on February 15, 1894, at Routhbhog in the Bikrampur section of the Dacca district, now a part of Bangladesh. He was the youngest child of Shri Govinda Chandra Guha and Brajalakshmi Guha. His mother whom the present author had the opportunity to know, was a pious lady and had a dominating influence on the life of Guha. His elder brother, Shri Suresh Chandra Guha, was a man of generous qualities from whom the young brother received considerable help of several kinds to remember all his life. He held his elder brother in high esteem. He received his early education in his village High School and passed the Matriculation examination (Calcutta University) in 1911 with High credit. Guha had a uniformly creditable academic career and secured scholarships, prizes and medals at all stages. He had his college education at the Dacca College (Calcutta University) from where he passed the B.Sc. (Hons) Degree examination in Chemistry in 1915 and the M.Sc. Degree in 1917, with the highest distinction.

Family

Professor Guha was married to Srimati Nalinibala, daughter of Late Rajendra Lal Ghosh and Charushila Ghosh. Much of the success of Guha as a scientist, teacher and researcher, was in a large measure due to the help which he received from his wife. She nurtured the energetic and rather impulsive and temperamental Professor and the host of students who worked with him, with a great deal of affection and kindness. She was a true mother to most of us who were associated with Professor Guha at the Indian Institute of Science, Bangalore.

Research Career

Initially, Guha had his research training under the guidance of Dr Watson, who was well known for his researches in dye-stuff-chemistry. After Professor Watson's departure from India, he got in touch with Acharya P. C Ray. This was the turning point in his career, as Sir P. C. Ray took great personal interest in shaping the career of this bright, young scientist. A quotation from Professor P. C. Ray is of interest :

"In 1916, *another young man of wonderful energy, pluck and perservance joined my laboratory. This was Praphulla Chandra Guha. He had just passed the B.Sc., from the Dacca College with Honours in Chemistry. Under ordinary circumstances he would have worked under Professor Watson but as the latter had gone home on furlough, Guha found himself nearly stranded. In despair, he wrote to me almost in piteous terms saying that his future career was about to be cut short abruptly and expressing an ardent desire to work under me. I welcomed him to my laboratory and thus began a happy and fruitful partnership. Guha was indefatigable in his labours and had a happy instinctive insight into the mechanism of reactions. I had now taken up the sulphur derivatives of mercury nitrite and he proved to me to be a God-send. In collaboration with him, I published two papers, but he was not long in striking out a path of his own. He has made substantial contributions on the chemistry of sulphur compound and has pointed out the untenability of the formulae of some of these as proposed by such veteran predecessors in the field as Freud, Arndt and Busch and has earned their congratulations. In due course, he came out with flying colours in his academic career also. He secured the first place in his M.Sc. and three years later his Doctorate and was also awarded the Premchand Roychand Scholarship."*

Association with the illustrious scientist, reformer and social worker, Professor P. C. Ray, proved to be of great benefit in shaping the character and destiny of Guha. Opportunities and honours came to him in quick succession. He received the *Palit Scholarship,* secured the Doctor of Science (D.Sc.) degree from the Calcutta University in 1923 and was also awarded the prestigious *Premchand Roychand Scholarship* in the same year.

Subsequently, Guha joined the University of Dacca as a Lecturer and then became the Reader in Chemistry in the same Department. His interest in those days was in organo-sulphur compounds.

At the Indian Institute of Science, Bangalore

When Professor J. L. Simonsen retired from the Chair of Organic Chemistry in the Indian Institute of Science, Bangalore, Professor Guha was selected to the Chair. He served the Organic Chemistry Department of the Indian Institute of Science, Bangalore, with great distinction for about 24 years (1928–52). He inspired a generation of students, many of whom have distinguished themselves. The influence of Professor Guha as teacher and guide, was vastly responsible for their success.

Contribution to New Knowledge

In the Indian Institute of Science, Professor Guha did pioneering work on the synthesis of mono and sesquiter-penoids and bridged bi-cyclic compounds. His investigations also covered stereochemistry, geometrical isomerism, sterichindrance, steric-effects in aromatic substitution and heterocyclic compounds. He initiated work on synthetic drugs, established preparative synthesis for well-known anti-malarials, sulpha drugs, local anaesthetics and many other useful products. He also made significant contribution to our knowledge of turpentine oil containing high proportion

of α-pinene, structure of rosin acids and other related products. Many derivatives were prepared from menthone and methods were established for the synthesis of β-aryl-glutaconic acids. He also studied the mechanism of addition of diazo compounds to conjugated double bonds with interesting results. Physico-chemical properties, such as parachors of certain bi-cyclic systems, were studies by him and he had drawn conclusions regarding their structure and stereochemistry.

Professor Guha would be particularly remembered for his work on Indian essential oils. He also took a keen interest in the study of other natural products, such as oils and fats, carbohydrates, colouring matters, etc.

During the War, Professor Guha took deep interest in the synthesis of important organic chemicals, many of which were synthesised and produced on substantial scale using indigenous devices. Some of the results directly helped the war effort of the Government.

Professor Guha's activities as a researcher actually covered almost all facets of organic chemistry. His papers, numbering about 300 have appeared in the leading national and international journals.

Qualities

As a person, Professor Guha was generous and hospitable to a fault. He would suddenly invite a large group of his students for lunch and dinner without the slightest notice and would leave the rest to Srimati Guha, who always rose to the occasion to accommodate the impulsive Professor. He took great interest in gardening and maintained one of the finest collections of Dahlias in Bangalore, not a mean feat, as the citizens of Bangalore are well-known for their enthusiasm for floriculture.

He had a large family, with 13 children—6 boys and 7 girls. He and his wife brought them up with great care. All the children did well in life and their professional career. Two of them were ace pilots of the Indian Air Force and sacrified their lives while in active service.

Last Days

After retirement in the year 1952, Professor Guha shifted to Calcutta and settled down in the Ballygunge area where he built a house. The later years of his life were not very comfortable.

He was sick for a long time, developed high blood pressure, diabetes and suffered paralytic strokes which practically immobilised him. The death of his two pilot sons had a stunning effect on him. He died on November 6, 1962 and was mourned by a wide circle of friends and a large number of students and admirers.

Honours

In his professional life Professor Guha received many honours. He was elected President of the Chemistry Section of the Indian Science Congress in 1936. He was

also a Foundation Fellow of the Indian Chemical Society, was a member of its Council for many years and also its Vice-President. He was elected a Fellow of the National Institute of Sciences of India (now the Indian National Science Academy) in 1935. He was associated with many other academic and professional bodies. A man of his enthusiasm and dynamism is hard to come by.

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S. C. Bhattacharyya

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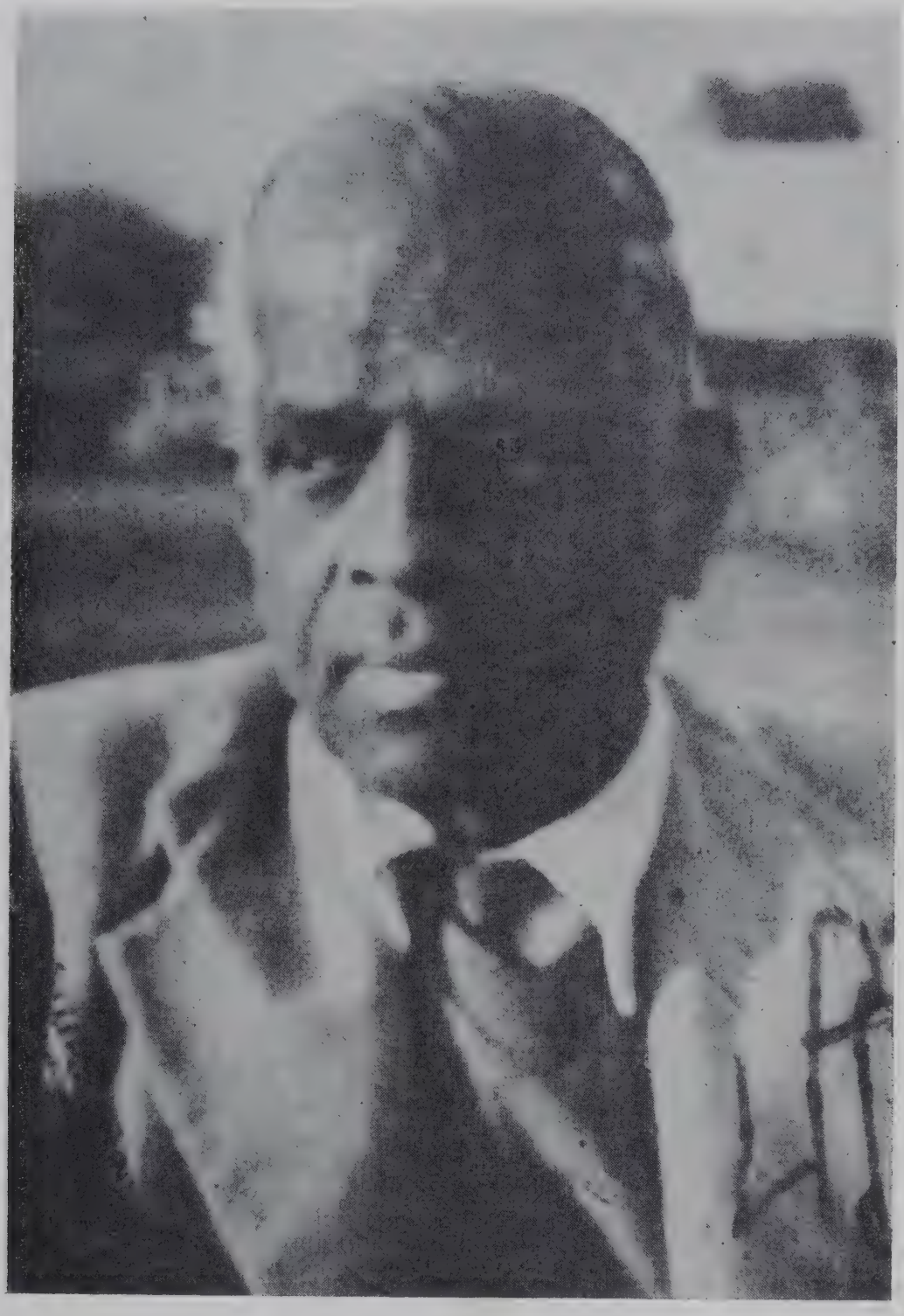

K. R. Krishnaswami

KOLAR RAMAKRISHNAIYA KRISHNASWAMI

(1898–1964)

Elected F.N.I. 1947

KOLAR RAMAKRISHNAIYA KRISHNASWAMI was born on August 14, 1898 in Kangayam, Coimbatore District, Tamilnadu.

He belonged to a family of middle class brahmins who migrated to Mysore State from the districts of Kanchi, Chingleput, North Arcot, Tirupati and Kalahasti. They were scholars in Sanskrit and many were of the priestly class who got several *manyams* (gifts of lands/villages) in Kolar district where they settled down as both scholars and agricultural landlords. His childhood was spent on the banks of the River Cauvery, mostly at Karur in Tiruchirapalli District.

Krishnaswami's father, Ramakrishna Iyer was an officer in the Madras Revenue service and was known for his forthrightness and quick disposal of revenue cases and appeals. He had three sons and three daughters and Dr Krishnaswami was the second of his sons.

EARLY YEARS (1898–1918)

Krishnaswami had all the care of his loving parents and from his childhood was industrious and showed great promise. He stood first in the high school examination where he had a high percentage of marks in Mathematics, Science and English, His parents thought he would be a good engineer/scientist.

However, the cold hand of cruel fate struck the family suddenly in 1912 and Mr Ramakrishnaiya passed away at the age of 52. The stricken family had to leave Tiruchirapalli and move over to Bangalore and later to Mysore under the care of their uncle K. Venkataswami Iyer who was an officer in the Mysore Educational Service.

After finishing high school, Krishnaswami joined the Central College, Bangalore. Chemistry was his special subject and he did well in it standing first both in his theory and practical papers scoring as high as 90% in theory and 100% in his practical examinations.

The question of higher studies or specialisation was remote during those days as facilities did not exist.

PROFESSIONAL CAREER (1918–1960)

After graduation in 1918 from Mysore University, he was offered a job as a Lecturer in the Vani Vilas Institute (a girls' school). He took up the job in a serene manner with hopes of switching over to research.

At that time, Mysore was just beginning to start industries and one of the most important was the Sandalwood Oil Industry. He joined the Sandalwood Oil Factory as a chemist where he helped standardise the method of distillation and other processes thus establishing it as one of Mysore's pioneer industries and as a good foreign exchange-earner. His work was noticed and recognition came from the Indian Institute of Science, Bangalore, where one of the professors praised the enterprising qualities of this young chemist. In 1921, he was appointed assistant to Dr H. E. Watson in the Inorganic Chemistry Department where he carried out important work involving chemical analysis and also laboratory scale industrial operation concerning the utilisation of various raw materials. His work became the bedrock for the starting of several industries in the State such as lac, soaps and glycerine, iron and steel, manganese and chrome, cement, paper, phosphate and fertilizers.

He was instrumental in establishing the dichromate factory at Belagola and the factory at Chickbanavar for the manufacture of copper sulphate and nitrates. He urged setting up a carbide plant and was responsible for the present utilisation of Chitradurga and Ingaldal copper. He was also a Metallurgical Consultant to the Kolar Gold Mines for a considerable time.

His association with Dr Watson had a tremendous influence on him. Dr Watson was very meticulous and fastidious in his work.

During this period the work in the Department of Inorganic Chemistry consisted of analysis of samples of ores and minerals like iron, manganese, chromite and others. There was also consultancy work for various industrial concerns. It was at this time that Dr Krishnaswami's interests took deep root-industrial chemistry, with a scientific attitude, carrying with it the rigour and emphasis on quality so assiduously practised by Dr Watson.

A turning point came in Dr Krishnaswami's career in 1928 when after seven years of fundamental research in this country, he was able, through the generosity and good offices of a friend of the family, to proceed to U. K. He left India in March, 1928 for London, for his doctorate.

Krishnaswami joined the London University and worked under Professor Donnan, and was awarded the Doctorate after 2½ years of research for his thesis on the 'Re-determination of the atomic weight of Tantalum' (a rare earth).

Most of the time in London, he stayed in the Parliament Hills area and had occasion to meet several persons who distinguished themselves in many diverse fields. Among these, mention may be made of Paul Robeson, Dudley Senanayake, Harold Macmillan and V. K. Krishna Menon.

After he was awarded the Doctorate by the University of London, Krishnaswami went to Germany and worked in the laboratories there for a few months before returning to India in August, 1930.

On his return from England, Krishnaswami was offered the post of the Professor of Chemistry at the University of Madras but he preferred to continue his association with the Indian Institute of Science and work under his guru, Dr Watson. He was appointed lecturer in the General Chemistry Department. Three of Krishnaswami's earliest students were Sunawala, Dave and Giri.

Dr Watson resigned in 1954 and went back to the London University to become the Professor of Chemical Engineering at the University College (1934–51). From 1934 until 1938 when Sir J. C. Ghosh was Director of the Institute and also Head of the Department of General Chemistry, no one was appointed in the place of Dr Watson, but the work was looked after by Dr Krishnaswami and his old colleague, Dr S. K. Kulkarni Jatkar. It was during this period that Dr Krishnaswami's bias towards industry grew and developed.

He had contacts with many industries and industrialists. Being highly practical, he frequently visited as a consultant, the various industrial units in and around Bangalore—Sandal Oil factories at Kuppam, Kolar Gold Fields; Mysore Chrome Leather Co; Mysore Spun Silk Mills at Channapatna; Mysore chromite at Arsikere; Manganese Mines at Sandur; Mysore Chemicals and Fertilizers at Vanaspati and Refined Oil Mills at Daevanagere; Mettur Chemicals Ltd; Mysore Govt. Soap Factory; Buckingham and Carnatic Mills; Ogale Glass Works; etc. He was associated with the Seshasayees' South Indian Gold Prospecting Co., in Wynaad (Nilgiri Dist.) and the Bombay Mint Scheme. He did field prospecting for gold, survey and sampling of phosphatic nodules in Tiruchirapalli District in 1930's and 1940's and a 2-month survey of sulphur deposits in Quetta (Baluchistan) in 1944. During 1942–44, he carried out investigations for, among other things, the recovery of precious metals from mint dross, sulphur from Baluchistan sulphur ore, production of strontium carbonate for signal flares from celestite mineral from Trichinopoly and gold from pyrite gold ore of Wynaad.

In the midst of all these industrial activities (and an equally hectic social and club life), he served as an Examiner to many of the Universities in India—among them may be mentioned Andhra, Annamalai, Calcutta, Madras, Mysore and Nagpur. He helped in placing a number of his students in suitable positions in Industry, University, Government Departments and in other Institutions.

In Bihar (1945–51)

After the Second World War, the Bihar Government was on the lookout for a suitable person to help in the industrial development of the state. Dr Krishnaswami was chosen and went to Bihar as Industrial Chemist in 1945. Soon after he joined, he was placed in charge of the newly formed Post War Reconstruction Board, Government of Bihar, covering all types of industries, minerals and metals, lac, leather textiles, ceramic and fertilizers etc.

He prepared a project report on Bihar Spun Silk Mills now in production at Bhagalpur and a number of feasibility reports on prospective industries such as ceramics, porcelainware, glassware, bone meal and chemicals. He drew up reports for several new and large scale projects utilising the raw materials abundantly available in the State. He arranged for drawing up specifications for the plant and machinery, secured quotations for them from foreign firms and furnished the Bihar Government with financial estimates of capital requirement and returns expected. He carried out a survey of the raw material resources and proposed industries that could be started with reasonable chances of success. These proposals were then

subjected to an examination by a high power committee that included Sir Jahangir Gandhi, Mr K. C. Mahindra and Sir Lala Sriram as members. The work carried out by Dr Krishnaswami in promoting industrial growth of the State was greatly appreciated by the Government of Bihar.

In 1947, he was elevated as the Director of Industries of the State of Bihar. In this capacity, he was responsible for the implementation of a large number of industrial projects and was closely associated with the Sindri Fertiliser factory. He was solely responsible for the setting up of : (*i*) Super phosphate factory at Sindri; and (*ii*) High Tension Insulation Factory at Ranchi, as he took up the entire planning and carried out the execution of these two factories. He was instrumental in starting the State Industrial Research Laboratory, which was very close to his heart.

He was also closely and actively associated with the progress of education in Bihar. He was the Member Secretary of the State Technical Education Committee set up by the Government of Bihar for fostering the cause of technical education in the State. Under his leadership and guidance, the College of (Bugihuring) Engineering (now called the Bihar Institute of Technology, Sindri, District Dhanbad) was set up. He also ensured that this Institution got off to good start by putting it on sound lines, administrative and technical. He was also a member of the Jails Reform Committee and was on the Board of Railways.

He was deputed by the State (1949–50) to visit U. K., France and Germany to place orders for the plant and machinery required for the new industries in the State. He also represented the State at several Conferences convened by the Union Industries Ministry for discussions in connection with the proposed Industrial Policy which was debated and finally passed by Parliament in April 1948.

The incessant tours he undertook as Director of Industries, Bihar and the heavy load of work he took on himself affected his regular habits and thus his health. He carried out most of the file-work at home in the nights as meetings, interviews and frequent inspection tours took up a lot of his time. The consequent strain was too much for him and his health suffered. He left Bihar and came to Bangalore where he was offered a Senior Professorship as Head of the Department of General Chemistry at the I.I.Sc. He took up the post in 1952 and continued till March 1961.

Last Years (1961–64)

After retiring from the Institute in 1961, he was Consultant to M/s. Essen & Co., Bangalore and Italab (private) Limited, Bombay reputed Industrialists and Analytical Chemists, respectively.

By this time, his health was failing and his movements were greatly restricted. However, his mind continued to be sharp and alert as ever.

On the eve of his death in the early hours of that Sunday, June 28, 1964,he had detailed discussions, he dictated lengthy note on "Laboratory Techniques of Gold Assaying."

Associations with Institutions

Dr Krishnaswamy was :

Fellow of the Royal Institute of Chemistry of Great Britain and Ireland (F.R.I.C.);
Fellow of the National Institute of Sciences (F.N.I.) of India;
Fellow of the Indian Academy of Sciences (F.A.Sc.);
Member of the Metallurgical and Geological Institute of India (M.M.G.I.);
President of the Royal Institute of Chemistry, London (Deccan Section)
President of the Association of Scientific Works of India,
Bangalore Branch — 1956–57 & 1957–58
Member, Atomic Energy Commission (Chemical Advisory Committee) — 1958–59 & 1959–60
Member, Executive Committee, Current Science Association 1958–59 & 1959–60
Member, Ores and Raw Materials Committee, Indian Standards Institution — 1958–59 & 1959–60

Personal Attributes

Tall and broad of shoulder, Krishnaswami had a well-proportioned and impressive figure. He believed in being well and properly dressed at all times. His honesty and integrity were unquestionable and with his ability and diligence he could have amassed a fortune as consultant and technical adviser to many industrial firms in the country. He spurned all offers of easy money and set a high example of personal honesty and rectitude.

Krishnaswami's interests were wide and varied. He designed, erected and worked a pilot plant at the Indian Institute of Science for the production of superphosphate from the phosphatic nodules of Tiruchirapalli (1942–44). In a similar manner, he erected a factory for production of sodium dichromate in Belagola near Mysore. In both these, he did practically everything from designing, through construction and fabrication, to working the plant. He set great store by doing things himself. He was a perfectionist and was reluctant to accept what was not up to his highly rigorous standards.

Krishnaswami was loyal and generous and elicited love and affection from his students.

K. R. Seshadri

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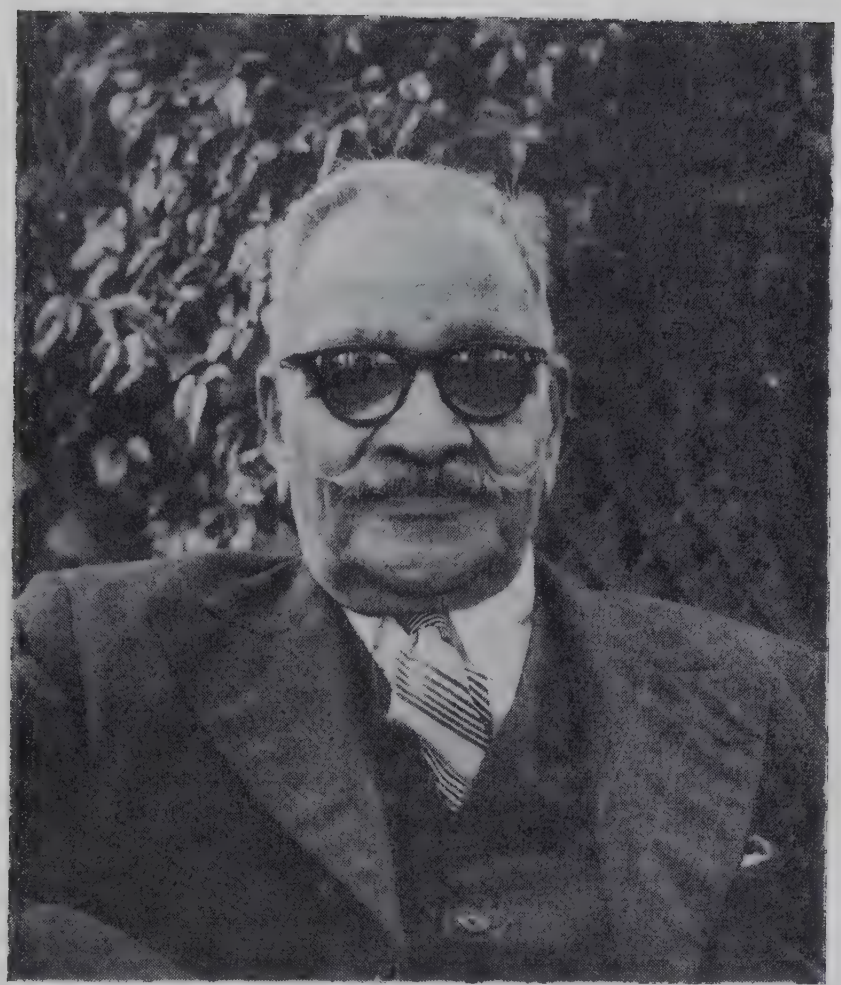

R. R. Moton

RAGHUNATH PURUSHOTTAM PARANJPYE

(1876–1966)

Foundation Fellow 1935

ON THE 6th of May 1966 (4.00 p.m.) it happened. The first Indian Senior Wrangler—Raghunath Purushottam Paranjpye—Poona's proud possession—breathed his last. There was grief in the city : and through the radio it spread over the country and beyond. His own College in Cambridge (St. John's), which had honoured him living (1945) by an honorary fellowship, now honoured his memory by lowering the College banner to half-mast जातस्य हि ध्रुवो मृत्यु—Yes, man is mortal, and 90 years is not a bad score. But, when towards midnight that day, my wife (his niece) received here (Udaipur) the sad news by a trunk call from Bombay, we were shocked—and bewildered "Why should it have happened?" It was commonly assumed that Paranjpye would hit the century. After the death (at 105) of Bharat Ratna Karve, people in Poona looked up to Paranjpye, his cousin, for anchorage as he too formed a valued, vital link with the past. Both shared the same family-stock known for longevity, and we expected that they would stand bracketted in regard to the span of life. Even otherwise, Paranjpye lived in his person a straight, balanced, good life. He never touched a cigarette or a drink. Whether in regard to conduct, expression or thought "the elements were so well mixed in him" that it is no wonder that he remained till death in full possession of his mental faculties and practically all his physical powers. He did not believe in reciting Vedic hymns but he was fully entitled to say with confidence, hope and justification :—

पश्येम शरदः शतम् । शृणुयेम शरदः शतम् ।
जीवेम शरदः शतम् । अजीतास्याम शरदः शतम् ।

Paranjpye loved children as dearly as Nehru did. He liked to fondle babies and this he did with the ease which experienced mothers might well envy. So, when his grand daughter got a baby-girl Ashwini, and a baby-son Gautam. I remarked to my wife that the two new arrivals in the family would definitely add years to his life. But divine dispensation was otherwise.

So much can be said and written about the colourful career of Paranjpye. I propose however to attempt, if I may, giving only a few flashes.

BIRTH AND EDUCATION

Paranjpye was born February 16, 1876. After his school education in India, he received his higher education from Cambridge University.

In the year 1899 (June) Paranjpye achieved at Cambridge what was considered (till then at any rate) the incredible. He was bracketted with George Birthwhistle as the Senior Wrangler of the year in the mathematical tripos. After all these years and judged purely as a performance in mathematical test, Paranjpye's fear is no longer unique. Within a decade of his return from Cambridge, India produced (in T. S. Rajan) another Senior Wrangler (1906). The Senior-Wranglership was abolished on academic grounds after 1909, but several Indians obtained and continued to obtain the highest honours the tripos could offer. Some again (including Paranjpye's own pupils and their pupils in turn) even surpassed him in a respect or two. It is also now possible to point out persons from India who have done valuable research work after their Cambridge career and whose names one hears mentioned with those working at the frontiers of the subject, such as Jayant Narlikar, Sudarshan, Abyankar etc. And yet, after all these years during which so much has happened to change the shape of things the significance of Paranjpye's Cambridge feat stands (and will stand) unequalled and undimmed.

The explanation lies in the fact that the emergence of an Indian as Senior Wrangler in 1899 was the first of a series of events which served to destroy the fiction (that had got built up) of the unchallenged supremacy of the West over the Orient. The first contacts with the West had the effect of overwhelming the East and it appeared that in any conflict with the West the East must go under. Paranjpye's success loosened, as it were, the first brick in this wall of Jericho. True, he was bracketted equal with an Englishman. But as the Master of St. John's College observed, when England and India drew equal, the achievement of India was distinctly higher. One might mention here a few other events which (happening later than 1899) served to restore the confidence and balance to the reeling East. By his remarkable performance on the Cricket field, Ranjit Singh beat Englishman on his own ground. And it is amusing of note that in those days, Cambridge Dons often made a delightful confusion between the two names Paranjpye and Ranjeet Singh. Another event, though of a different order of magnitude, was the naval victory of the Japanese Admiral Togo, against Russia (1904) which resulted in the capture of Port Arthur and the annihilation of the Russian fleet. Then came in 1913 the award of the Nobel Prize to Rabindranath Tagore who for the first time brought that distinction to the East of Suez.

The 1899 success of Paranjpye was not a mere individual success. It had a significance for the entire Asiatic Continent. It arrested the process of collapse of confidence in the East. Time cannot efface this significance. History will not engulf it.

A Diversified Role with an Abiding Impress

During the fifty eventful years—the first half of the 20th century—Paranjpye played many roles in the public life of the country: e.g. Principal of the Fergusson College (over twenty years); Minister in the Bombay Cabinet (over three years); Member of the India Council (for five years); Vice-Chancellor of the Lucknow University (for six years); India's first High Commissioner for Australia (for three years) and Vice-Chancellor, Poona University (three years)—not to mention his membership of

Committees like the Reforms Enquiry Committee and the Taxation Committee. His record of service is characterised by ability, distinction and integrity. Which one of these various roles can be said to have left an abiding impress on the course of events? Or, to put the question differently—If Father Time were to agree to put back the historical clock and give Paranjpye the choice to serve the country once again in any of the above-mentioned capacities for five years, which one would be have chosen? I have no doubt that it would be the Principalship of the Fergusson College. No one remembers the Members of the India Council because none cared even to know their names. Vice-Chancellors and Ambassadors play their part on the stage and are soon forgotten. But the services Paranjpye rendered as the Head of the Fergusson College influenced, through generations of students, almost all the fields of national activity. During his long association with the College as Principal, he raised it to a status and prestige admired and envied all over the country. His name in fact became synonymous with that of the Institution. But that is not the secret of his influence on the public life which because of his students, persists even today. I can only attempt an explanation. As Principal, the Professor of Mathematics he did not merely teach Mathematics to the students; but he educated generations of them in the real sense of the term.

"Education prospers by economy, by exclusion. Two principles must be observed in it. The first is that certain subjects—they cannot be more and should hardly be less than two—must be studied so thoroughly that the pupil gets some idea of what knowledge really is. That lesson cannot be learnt by studying a large number of things; it demands time and concentration. The second principle is that these subjects should bring the pupil face to face with something great. Nothing—not all knowledge in the world educates like the vision of greatness and nothing can take its place." (—Some Tasks for Education. Livingstone p. 17). Paranjpye gave students just this vision of greatness. All students had to study Mathematics in those days in the first year class, and several of them left the subject in the second year of the College. Paranjpye had usually only one period in a week with the first year students. But that was ample for him to give them the vision of greatness. It is not necessary to read through a complete epic. Just study one Canto of *Paradise Lo* one 'Parva' of *Mahabharat,* or one 'Kanda' of *Ramayana,* and it is enough to lift up your minds and educate you as nothing else may. It is not difficult to imagine how Paranjpye could work this trick in a weekly period. When he entered the class, his personality, invested with his Cambridge reputation, was itself a vision of greatness. Then as regards his teaching of Mathematics he never made the cheap show of giving a ready solution to a difficult problem, asked in the class. He would write down the problem on the board, look at it, attempt alternative methods of attack and as it were struggle with it before finally writing down the solution. When students saw their Senior Wrangler think over, and struggle with a problem they obtained a glimpse of what knowledge is, and of the price it exacts. Again Paranjpye always gave the historical setting and background of whatever he taught—be it Calculus, Algebric, Geometry or Trignometry. And finally, he was always careful to bring to the notice of the class the latest side-lights on the subjects. I cannot say what proportion of his students benefited by his teaching so far as examinations are concerned. But I have no

doubt that everyone who came under his influence left the College, 'educated' in the real sense of the term.

Transition from Mathematics to Politics

Regarding Paranjpye's life and career, three issues are raised—(i) Whether Paranjpye lost much by forsaking Mathematics for politics, (ii) Whether the nation as such lost by this step on his part, and (iii) Whether it is wise in the abstract to allow such transition from one sphere of activity to another?

The present writer is not disclosing a secret in stating that, even if given the option to begin his life again, Paranjpye would not have willingly reversed a single step in his long career except that of accepting the post at the India Office. Success at research can never be guaranteed. Many of the great researches are accidental. Apart from the natural aptitude and talent which one grants Paranjpye possessed in full measure, success at research is conditioned by a number of external factors over which he could have, in his time, absolutely no control.

Let us consider the nation's point of view. Has the nation lost on the whole by Paranjpye's giving up research or has it not? The answer to this depends upon what you conceive to have been the needs of the country when Paranjpye was faced with the choice. His career as Principal proved in an unmistakable manner that through mere private effort Indians could achieve astounding results in the field of national education. Research?—yes, perhaps it was sacrificed. But did not the nation require his services for something that was more urgent at the time, and still continues to be more urgent? Does it not happen that in times of national emergency individuals' services are requesitioned for purposes grossly inconsistent with their aptitudes? Paranjpye felt that in the current state of education of our country there is a want of able conscientious workers in so many departments. Research could wait; education of the nation could not. He realised that the call of public service was more insistent than the call for research. If the readers agree that the question has this other side to it, they might well persuade themselves to leave the matter to the individual judgment.

There are critics again who argue that educationists have no business to dabble in politics. This view, so far as it is sincerely held, arises from a complete misconception of our accepted ideas. Ours is not the ideal republic of Plato, or a 'totalitarian' state like that of the Nazi Germany, or the Fascist italy, where men embracing a certain type of clear-cut ideology are to be the rulers of the country. Our ideal, on the contrary, closely takes after Aristotle's "state where the citizens as a body govern in accordance with the general good." Every national is supposed to be interested in the management of the state, and any one so desirous may take part in its politics. We might well enquire of the critics, who, according to their view, should take to politics? If educationists are to be barred, on what principle are they going to allow lawyers or doctors? "Politics is inseparable from life", observed Mr. Shastri. It cannot be a profession. It is the concern of all and thus remain as such in a country with democratic ideals. It is even possible to go further and argue that the entry of

the educationist into politics is really to be welcome if only to maintain the tone of moral earnestness unimpaired in the flow of national life.

Paranjpye's again, is by no means, a solitary instance. Bhandarkar's is another. Mr. J. M. Keynes was the twelfth wrangles in 1905, but he later gave up Mathematics in favour of Economics. He rose to an international position as an English economist of the first rank. It is easy to multiply illustrations to show that a transition from one sphere of activity to another is not necessarily an evil. We may also mention the famous case of Alfred Marshall, again of Paranjpye's College St. John's—who was the second Wrangler in his year (1865) but who later turned to Economics. He was not only the most influential economic theorist of his day but also a great teacher. He trained generations of ardent students who in turn have trained a large proportion of the active economists in the British Empire and elsewhere. One often wonders whether the two Johnians were not born under the same star.

Paranjpye as a Person

As a person, Paranjpye was essentially human and lovable. For that very reason probably he had some amusing contradictions. By no means an orthodox, he yet always wore the sacred thread. Though a nationalist, he could never rid himself of the supersitious fear that as a breech-born baby, he was in danger of being struck by lightening. Nehru spoke of Karve "as a sage the like of whom trod this land in ancient times." This remark is significantly true of Paranjpye. All the three—Nehru, Karve, Paranjpye—were agnostic, Paranjpye perhaps, more determinedly so. And yet no theist, in my knowledge, lived up to the ideal, preached by GITA, as Paranjpye did,—the ideal of a commendable degree of detachment to the sweets and bitters of life.

G. S. Mahajani

Note : Bibliography unobtainable in this case.—*Editor*

BASUDEVA NARAYANA

(1898–1967)

Elected F.N.I. 1946

Birth, Parentage and Childhood

Basudeva Narayana was a distinguished physiologist of India. Born on November 19, 1898 at his maternal grandfather's village in the former Saran District of Bihar, he was the eldest among three sons and a daughter of Rai Bahadur Sukhdeva Narayana, Deputy Collector in the Bihar Civil Service. His uncle, Raghubir Narayana, was a renowned poet of his day, who won the prestigious award of the Bihar Rashtra Bhasha Parishad in 1952, for his contribution in Hindi Literature; he is still remembered for his famous lyrical poem, "*Batohia*", which became popular as a patriotic song throughout Bihar and eastern U.P., during the days of India's freedom movement.

Basudeva Narayana was brought up in his ancestral home at Chapra. In his formative years, he imbibed the virtues of honesty, discipline and hard work from his father, and those of simplicity and large-heartedness from his mother, Gulab Devi, to whom he was greatly devoted. In fact, he often used to say that his mother had influenced him most in his life. Kind and affectionate, she had made it a mission of her life to help the poor and needy. In keeping with this motto, she provided free board and lodging in her house to a number of poor boys while they pursued their studies. It was in their company that the young Basudeva grew up. As part of his training indiscipline, he had to foot the distance to school and back home every day; he had also to conform to the family norms of simplicity in dress.

Narayana's early childhood was marked by a series of illnesses which kept him confined to bed quite frequently. Frail, and dogged by ill health, he was the centre of attention of his parents, who seemed to have despaired of their son ever being fit enough to carry on his normal studies. His primary education was, therefore, a casual affair at home under a private tutor.

School and University Education

When Basudeva entered school, he had crossed the age of eight. He spent four years at the Saran Academy, Chapra (1907–11), and the rest at the Government Chapra Zila School (1911–15), where he passed the matriculation examination in

B. Narayana

1915 in the first division, with a local scholarship to his credit. In those days, the matriculation examination in Bihar was controlled by the Calcutta University although the Province of Bihar, including Orissa, had been separated from Bengal.

Foremost among the teachers who exercised a profound influence on the mind of young Basudeva Narayana and helped him build his career at the Chapra Zila School, were Rai Saheb Trailokya Nath Ghosh, the Headmaster, and Babu Rasiklal Roy and Babu Ram Lakhan Sahay. They were all teachers of the highest calibre. Apart from taking a personal interest in the education of the boys at school, they used to contact the guardians from time to time and report on the progress of their wards. Then there was Moulvi Abdul Halim, the family tutor for Persian and Urdu. Able as a teacher, he possessed exemplary qualities as a man. He was more like a member of the family, and participated in all its social and religious functions.

On completing his school education, Narayana entered the Patna College for the I.Sc. course and passed the examination in 1917 in the first division. He then joined the Presidency College, Calcutta, where he graduated in 1919 with Chemistry, Botany and Physiology Honours, standing second in order of merit. He took his M.Sc. degree in Physiology in 1921, obtaining a first class. Along with the M.Sc. course, he studied the pre-clinical course of the medical curriculum, taking the M.B. degree from the Calcutta Medical College in 1924.

Even as a student of Presidency College, Calcutta, Narayana developed a deep interest in Physiology under the inspiring guidance of his mentors like Professor S. C. Mahalanobis and N. C. Bhattacharya of cherished memory; and with the passing of time, his fascination for physiology took deeper roots in his mind, urging him on to still greater effort and achievement in his career as a scientist.

Professional Career and Research

After a short spell of medical practice at Chapra, Dr Narayana entered the Bihar State Medical Service as a Demonstrator in Physiology at the Prince of Wales Medical College, Patna, in 1926—the year in which the college started functioning as a full-fledged medical institution. Two years later, he became a Lecturer in the same Department, a post he held till his elevation to the Chair of Professor in 1935.

Among the Foundation Professors of the Patna Medical College, Dr E. W. H. Cruickshank, Professor of Physiology, deserves special mention; it was under his able guidance that Dr Narayana started his research. Professor Cruickshank, however, left towards the end of 1928, to take up an assignment as Professor of Physiology at Dalhousie University, Halifax, Canada, and later as Reguis Professor at the University of Aberdeen, Scotland. He was succeeded by Professor Charles Reid, under whom Dr Narayana carried on his work before proceeding to Edinburgh, in 1932, for advanced studies and research in Physiology.

At the University of Edinburgh he worked under Professor Sir Edward Sharpey-Schafer, an eminent Physiologist of his time, and then under Professor

I de Burgh Daly, when the former retired. He also worked under Professors J. Demoor and P. Rijlant at the Institute Solvay de Physiologie at Brussels, during the summer months of 1933 and 1934.

Narayana's research in Edinburgh was on the action of drugs on smooth muscle. He was awarded the Ph.D. degree in June 1934 for his thesis entitled : "Observations on the action of ergotamine." In the opinion of both his guide and his referee, his thesis "reached a high standard and showed considerable ingenuity in overcoming the special difficulties involved in the research."

From June 1934 until his departure for India, the following December, Dr B. Narayana devoted his attention to the study of mechanisms responsible for the control of the pulmonary circulation and air tubes. As a result of this work three papers were published : (1) Investigations on the Pharmacology of evipan sodium; (2) observations on the perfused lungs of the guinea pig; and (3) the action on perfused lungs of drugs injected into the bronchial vascular system. For some time he worked as Demonstrator in Human Physiology and Biophysics at the University of Edinburgh.

Shortly after his return to India in 1934, Dr Narayana became Professor and Head of the Department of Physiology at the P. W. Medical College, Patna. In 1946, he succeeded Dr T. N. Banerji as Principal of the Medical College and Dean of the Faculty of Medicine, in addition to holding the post of Professor of Physiology. It was during his Principalship that the College celebrated its Silver Jubilee in February 1952, when Dr B. C. Roy, the then Chief Minister of West Bengal, inaugurated the celebrations. Professor Narayana spared no efforts to raise the standard of teaching in the various departments of the Medical College, and to ensure the smooth and efficient functioning of its hospital. A number of research students also came to work under him.

As Vice-Chancellor of Patna University

On his retirement from government service in December 1953, Dr Narayana was offered the post of Vice-Chancellor of Patna University, which he accepted. He served as Vice-Chancellor for the full term of three years—January 1954 to March 1957. During his tenure, he developed the scope and quality of teaching in the colleges and University departments, and brought about notable improvements in several other fields of activity. For instance, he established eight postgraduate departments and six diploma courses in the Faculty of Medicine, and introduced the teaching of sociology and ancient Indian History and Culture at the undergraduate level. He also centralised Honours teaching in the Faculty of Arts, and increased the number of seats for girl students in the Faculties of Science and Medicine.

He initiated a scheme of health services for the students and staff of the University, and improved their residential facilities. Another scheme, meant for the benefit of the teachers, was launched in which two teachers were to be granted leave every year for higher studies abroad. Together with this, a revolving fund of nearly a

lakh of rupees was created for granting interest-free loans to six teachers of the University, annually, for overseas study.

Activities in the Fields of Science and Education

In the year 1958, Dr Narayana joined the then recently started Rangaraya Memorial Medical College at Kakinada, in Andhra Pradesh, as Principal and Professor of Physiology. This was in response to the invitation of the Medical Education Society of Kakinada. He served the infant institution until 1962.

Once back to Patna, he took up Honorary Professorship in his parent department, which he had served with singular zeal and devotion for nearly 25 years. He continued to teach in this capacity till his last days.

Dr Narayana was unrelenting in his efforts to promote science and education in India, which made him lead a busy and active life throughout his professional career. He was examiner in Physiology for postgraduate and undergraduate examinations at several university centres in the country for more than 30 years, and served as Visitor and Inspector of Medical College in India, on behalf of the Indian Medical Council, for over 15 years. He was a member of the Senate of Patna University from 1930, a Life-member of the Senates of all the Universities of Bihar, and from 1958 to 1962, a member of the Senate and Board of Studies of Andhra University. He also acted as ex-officio Chairman of the Bihar Secondary School Examination Board in 1955 and 1957. Further, he presided over the Governing Body of Rajendra College, Chapra, for three years, and over the Managing Committee of a secondary school in his native village, Nayagaon, since its foundation until 1965. He was connected with the St. John Ambulance Association, Bihar, for many years, being a recipient of the Associate Serving Brother Medal of the Order. He was the first Secretary of the Bihar State Branch of the Indian Medical Association and its President.

Foreign Tours, Honours and Other Distinctions

Eminent educationist and scholar of renown, Dr Narayana travelled widely, not only within India but also to distant parts of Europe and the United States, for the advancement of medical science. He spent six months—September 1949 to March 1950—in the United Kingdom and U.S.A., as a Travel Fellow of the United Nations World Health Organisation, to study the set-up of medical education in the two countries. In this period, he visited some thirty universities in the U.S.A. and about ten in the U.K., and met and held discussions with a large number of eminent scientist including Sir Alexander Fleming.

In 1956, Dr Narayana attended the International Physiological Congress at Brussels where he had occasion to meet many distinguished physiologists from all over the world, among whom were such luminaries as Lord Adrian, Professor Wiggers, Burns and McDowell. After the Congress, he toured a number of other countries of Europe to study, first-hand, the advances made in the field of Physiology.

As leader and doyen of Indian physiologists, Dr Basudeva Narayana rendered yeoman service to the cause of medical science. He may rightly be regarded as one of the main architects of medical education in the country. He drew up a comprehensive plan to raise India's medical education to the level of that in the West. It was largely the result of his ceaseless efforts over the years that a sizeable number of medical colleges and postgraduate research institutes came into being in the country. Many among his pupils have held positions of eminence in different parts of the country.

Contributions to New Knowledge

Soon after joining the Department of Physiology at the Prince of Wales Medical College, Patna, in 1926, Dr Narayana started research work on an experimental study of the action of insulin in normal and diabetic hearts. When both insulin and sugar were administered in the blood circulations of a normal and a diabetic heart, no significant difference was observed. Anaesthetics like chloroform and ether reduced the glycogen content of the heart, while Amytal did not materially affect it. The anaesthetics did not affect the action of insulin.

He then proceeded with the investigation of factors causing variations in the blood diastase level in animals like dogs, cats and rabbits, and in human subjects. He found that the blood diastase level decreased after meals, on injection of glucose, glycogen and insulin, while it slightly increased after administration of anaesthetics and injection of starch. The pancreas was not found to be the main source of blood diastase. Evidence showed that liver cells took up or gave out disastase, thereby decreasing or increasing the blood diastase level. He also made a detained study of blood glycolysis.

During his experimental work, he developed an improved kymograph, details of which appeared in the *Proceedings of the British Journal of Physiology,* in 1931. It was meant to be used for research work where slow speed was required, and also as a students' demonstration kymograph.

Dr Narayana proceeded to U. K. in 1932, at Edinburgh, he carried out research work on the effect of evipan sodium on the frog's heart. Evipan sodium produced a depressant effect on the heart which was removed by washing and anatagonised by adrenalin. This anaesthetic also produced a slowing down of respiration and reduction in temperature, but blood sugar remained unaffected. He then investigated the behaviour of isolated guinea-pig lungs to drugs. Acetylcholine produced vasoconstriction and broncho-constriction, which were abolished by atropine but unaffected by eserine. Adrenalin also produced vasoconstriction. Then he proceeded with the investigation of the mechanism for the control of the pulmonary circulation and air-tubes of dogs. He proved that the injection of histamine and adrenalin in the bronchial circulation produced respectively diminution and augmentation of tidal air volume and that the bronchoconstrictor effect of histamine was released by subsequent injection of adrenalin.

He then took up the investigation of drugs like ergotamine, adrenalin and pituitrin on the coronary vessels of dogs. Ergotamine produced a slight vasodilatation.

Vasodilatation brought about by adrenalin was not abolished by ergotamine. Pituitrin, on the other hand, produced vasoconstriction of the coronary vessels. These were some of his significant contributions to new knowledge.

Honours

In recognition of his services to the cause of medical education and for the advancement of Physiology in India, he was elected the first Honorary Member of the Association of Physiologists and Pharmacologists of India in 1964.

Dr Narayana, in the course of his career and even thereafter, was associated with various scientific societies and governmental committees in one capacity or another. He delivered popular lectures at different university centres, and addressed a number of scientific forums.

Membership/Fellowship of Learned Societies

1. Member of the British Physiological Society : 1930
2. Fellow of the Royal Society of Edinburgh : 1935
3. Fellow of the National Institute of Sciences of India : 1946
4. Member of the Indian Council of Medical Research : 1946–52
5. Member of the Scientific Advisory Board of the Indian Council of Medical Research : for 3 years
6. Member of the Medical Council of India: 1948–65 and its Vice-President: 1960–65
7. Member of the Association of Physiologists & Pharmacologists of India : 1955 and its Honorary Life Member : 1964
8. Fellow of the Indian Academy of Medical Sciences : 1961.

Governmental Committees

1. Member of the Government of India Family Planning Committee : 1953–56
2. Chairman of the Bihar State Family Planning Board: 1954–65
3. Member of the Government of India Committee to advice on the cost of setting up medical colleges: 1957.
4. Member of the Government of India Committee to suggest the site for the location of a second medical college in Rajasthan: 1957–58.
5. Chairman of the Expert Committee of the Government of Assam for establishing a second medical college: 1960.
6. Member of the Government of India Committee to report on the Therapeutic Claims of Yogic Practices: 1960–61.

Popular Lectures and Addresses

1. Presided over the Physiology section of the '30th Indian Science Congress' held at Calcutta, the subject of his Presidential address being "The growth of Physiology as an experimental science" : 1943.

2. Delivered the Sukhraj Roy Readership Lectures at the Patna University on "The Physiology of the Lung" : 1951.
3. Delivered Extension Lectures at Agra University on "The Growth of Physiology" and on "Pulmonary Circulation" : 1953.
4. Addressed the Annual Convocation of Patna University : 1966.

Reminiscences of Private Life

Dr Narayana had a happy family life. He was married in 1916 to Shyam Nandani Devi, a pious lady and a good housewife devoted to the family. They had a son and three daughters. Now they are all married and settled. His wife, who has survived him, lives with her son in Patna.

The most striking feature of Dr B. Narayana's personality was his simple, frank, and unassuming nature. A firm believer in austerity in personal living, be decried vain pomp and show. For example, he retained his old model Austin car of the 1930s throughout his public life, even when he was Vice-Chancellor, and would not heed the advice of friends and relatives to change it for a new model. His car could be spotted from a long distance, as it was the only one of its kind in town. He was averse to the idea of building a house for himself or his family. On his return from Kakinada in 1962, he lived with his son in a small rented apartment in Patna.

In matters of dress, Dr Narayana was very conservative. He never donned a bush-shirt in his life; he was to be seen, invariably, in a three-piece suit and a felt hat, holding on his lips a cigarette at which he seldom puffed. At home, he usually were a dhoti and shirt. Like his other habits, he was used to simple vegetarian food.

Dr Narayana advocated simplicity in respect of university education as well. He believed that for education to serve a higher purpose, it had to be free from modern trappings. So far as medical education in India was concerned, he emphasized the need for the basic minimum requirements for proper teaching and such medical treatment as even the poor could afford. He was strongly of the view that efficiency and sound clinical sense for outweighed modern sophisticated gadgetry.

Besides being a proficient teacher, Dr Narayana was a great moralist who laid equal stress on education and character-building, and who had deep respect for human values. Known for his kindness and generosity, he was ready to help those who came to him with their problems. He was popular among all sections of society, and was held in veneration by his students. Endowed with a prodigious memory, he had facts and figures at his finger-tips. He was methodical in his work, with a practical, commonsense approach to all problems. Over and above these qualities, he was a good conversationalist, gifted with a subtle sense of humour. The noble traits of his character, coupled with scholarship, gave him a personality that commanded both love and respect.

Illness and Death

Dr Narayana's health suffered a serious setback early in 1967, when he was laid up with cirrhosis of the liver. A few months of intensive treatment and care,

however, brought him round. But his condition took a turn for the worse again in October. He was rushed to the Patna Medical College Hospital in a state of hepatic coma, from which he never recovered. He died on the morning of 26th October 1967, leaving behind a glorious record of service dedicated to the cause of education in general and of medical education in particular.

His death was deeply mourned and glowing tributes were paid to his memory by a large number of his friends and admirers from all over the country, and by those institutions with which he was closely associated. Dr Narayana will long be remembered for his many sterling qualities.

A. S. Sinha
K. D. Narayan

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MAHARAJAPURAM SITARAMA KRISHNAN

(1898–1975)

Foundation Fellow 1935

Birth, Early Life and Education

Maharajapuram Sitarama Krishnan was born in a Brahmin family in the town of Maharajapuram of Tanjore district of Tamil Nadu in August, 1898. He got his early education in Tiruchirapally and his higher studies in the University of Madras.

Graduating with honours in Geology in 1919, he was awarded the M.A. degree of the Madras University in 1921 with very high distinction. He worked as Demonstrator in the Geology Department of the same University for two years, with a break of about five months on an assignment as a field geologist in the Central Provinces.

Higher Education

Krishnan proceeded to U.K. with a fellowship for higher studies in geology and was admitted to the Royal School of Mines of the Imperial College of Science and Technology, London. In 1922, he was awarded the associateship (A.R.C.S.) and the research diploma (D.I.C.) of the Imperial College. In 1924, he was qualified for the Ph.D. (Science) degree of London University. His Ph.D. thesis was based on petrographical studies of the different rock-types, occurring in the neighbourhood of Mount Girnar and Osham hills of Saurashtra. In London, he worked under the guidance of the late Professor W. W. Watts, F.R.S., and late Dr J. W. Evans, F.R.S., and subsequently obtained special training in Mining Geology from the Royal School of Mines.

Professional Career

Dr. Krishnan returned to India at the end of 1924, and joined the Geological Survey of India (G.S.I.) as an Assistant Superintendent in the officers' cadre. By dint of his merit and by his devotion to research work, he was promoted to the rank of a Superintending Geologist of the G.S.I. in the year 1943. From 1924 to 1943, Krishnan conducted extensive field-work in the Orissa districts of Gangpur, Bonai, Bamra and Keonjhar. In Gangpur, Krishnan's observations were considered as pioneering, on the stratigraphical sequences of the Gangpur Series of rocks, in which he could demarcate a definite stage, which was later named as '*Gangpur State of Krishnan.*' Later on, he carried out numerous field investigations on the economic

M. S. Krishnan.

mineral deposits of the former Madras Province, which is very well narrated systematically in Memoir No. 80 of the Geological Survey of India, on the Mineral Resources of Madras Province.

Teaching Career

Dr Krishnan was very much interested in teaching geology to the students of different disciplines. He acted as a Lecturer in Geology for three successive seasons from 1927 to 1929 in the Forest College, Dehra Dun. He also taught geology to the honours students at the Presidency College, Calcutta from 1933 to 1935. Krishnan was very closely associated with the organisations of teaching geology in several Indian Universities. He was invited by one of his old friends, the late Professor C. Mahadevan, F.N.A. of Andhra University, and spent a few years in the Geology Department of the University after retirement. The University was very much benefited by the wise counsel of Dr Krishnan in developing the laboratory of mineral technology and applied geophysics.

Multi-faceted Career

Dr Krishnan acted as a Curator of the Geology and Mineralogy Section of the Indian Museum in 1935–36. In 1949, Krishnan accepted the post of Director of the newly constituted Indian Bureau of Mines and reorganised the Bureau very efficiently. In February 1951, he relinqished the post of Director and became the first Indian Director of the Geological Survey of India, on the retirement of Dr W. D. West, F.N.A. Krishnan had acted as Assistant Director of the Geological Survey of India from 1938–39, when he was responsible for guiding the largest single field-party and the training of several young geologists of the Geological Survey of India. Krishnan also acted as the Mineral Adviser to the Ministry of Natural Resources of the Government of India, from August 1955 to January, 1957. He spent a short period of 1935 and 1936, in U.K., U.S.A. and Canada, on study leave acquiring knowledge of applied geophysics and visiting the important centres of mining in those industrially advanced countries. On his return to India in 1936, he was appointed a Member of the Coal Mining Committee of the Government of India, the report of which contains a minute by Dr Krishnan and the late H. K. Nag, the eminent mining engineer, advocating nationalization of coal mines, with the acquisition of royalty rights as a first step; this was considered to be a revolutionary recommendation in those days, but later on it was accepted by the Indian Coalfield Committee in 1947, where Dr Krishnan played an important role. In 1946, Krishnan was a member of the Indian Science Delegation to the Royal Society Empire Scientific Conference held in U.K. In 1947, he was sent on special deputation to Europe and U.S.A. to study the present methods of work in the investigation of radio-active and rare-earth minerals, which formed the nucleus of the Atomic Minerals Division of the Department of Atomic Energy.

Krishnan acted as the Chairman of the Committee, appointed by the Government of India, for the conservation of metallurgical coal in India in 1950, which

recommended the immediate nationalisation of the metallurgical coal in India. In 1949, he was deputed as a member of the Indian delegation to the United Nations Scientific Conference on the conservation and utilisation of natural resources particularly iron-ore resources of the world, which was held at Lake Success in the United States. Under the U. N. Project, Krishnan visited almost all the important iron-ore producing countries of the world. The comprehensive report of the global iron-ore resources was published by U. N. in 1954, which contains several important suggestions by Krishnan.

Krishnan was President of the Geology and Geography Section of the Indian Science Congress in 1935, when he delivered the Presidential Address on the Dharwarian Formation of Chota Nagpur District, Bihar, on the basis of some problems of their correlation and sedimentation. Krishnan also became the General President of the Agra Session of Indian Science Congress in 1956. His Presidential Address relating to the conservation of high grade economic minerals and ore-deposits was of great significance to a developing country like India, which had to import several economic minerals from abroad for her mineral-based industries.

Krishnan was a Foundation Fellow of the Indian National Science Academy and took keen interest in the various activities of the Academy.

He was also Fellow of the Indian Academy of Sciences, Member of the Geological Society of London, American Institute of Mining and Metallurgical Engineers and member of the Editorial Board of the well-known journal, *Economic Geology,* published from the Yale University, U.S.A. He was the author of about 100 scientific papers.

After retirement from the post of the Director of Geological Survey of India, he was appointed Director of the Indian School of Mines, Dhanbad. The Government of India selected him to implement the programme of reorganisation of the School of Mines for training in Applied Geology, Mining Engineering and Mineral Technology. This training was urgently needed for implementation of the successive five year plans.

A few months before his sad demise in 1975, he was invited by the Australian Government to visit Australia and New Zealand, where he spent about two-and-a-half months in acquiring first hand knowledge about the sophisticated techniques of scientific mining and prospecting.

In May, 1975, he went to his birthplace, Maharajapuram in order to settle some family affairs. He suddenly fell ill and was removed to a nearby Medical College Hospital where he was operated upon by two eminent surgeons of the College. He was unable to stand the shock of such a complicated abdominal disorder and died on the third day after the operation.

Krishnan left a landmark in the history of the development of Indian geology, particularly in the field of Indian Economic Mineral Deposits. The Geological Survey of India with its widening sphere of activities, was very much benefited by Krishnan's remarkable quality for excellent organisational ability. He was responsible for planning the future expansions of different departments in the

headquarters and in other regional centres. His name will be remembered as one of the pathfinders and pioneer workers in the domain of Indian earth sciences.

Students of Earth Sciences in Indian Universities will cherish his memory with gratitude for the *Text-book on Geology of India and Burma*. The book has been translated into Russian and Hindi.

S. DEB*

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*Since passed away

JNANENDRA NATH RAY

(1897–1968)

Elected F.N.I. 1935

JNANENDRA NATH RAY was born on the February 17, 1897 at Tilli in District Dacca now in Bangladesh. He was the eldest son of the late Purna Chandra Ray, a pioneer chemical engineer and one of the founders of the match industry in India.

EDUCATION

At a very early age Jnanendra lost his mother and as his father was away a great deal on business, it was decided that he should stay with his maternal uncle at Rajshahi, where he joined the collegiate school and in his early years appeared to be more interested in sports and dramatics than in his studies. However, he took more than an ordinary interest in writing English and his precis work was good enough to make the headmaster (who was also the teacher of English), to read out his work as an example to the class. He also had a great interest in history and this interest he sustained throughout his life.

In those days, Sanskrit was compulsory and the pandit who taught the boys was a figure of fun to them and was not taken seriously. However, just prior to the prematric selection examinations, the seriousness of the situation dawned upon the students and their attitude changed very fast. The pandit watched gleefully wondering if all would fail. The midnight oil was burnt and the results were quite good. Much to the surprise of the pandit, Jnanendra stood first in the school examination. Sometime before the final examination, he had a severe attack of typhoid followed soon with a relapse. Though quite weak, he appeared at the Matric examination and did well.

Being left on his own from an early age made him self-reliant and independent in character.

Later, he came to Calcutta and joined the Presidency College to do his Inter-Science and then the B.Sc. examination. During the years at the Presidency College, he was in the college cricket, hockey and football teams and revived his interest in dramatics, though he did not let these activities come in the way of his studies. After passing the B Sc. he went over to the College of Science to do his M.Sc. It was here that he came under the influence of the late Acharya Prafulla Chandra Ray. On passing the M.Sc. (Chemistry) examination in 1919 with distinction and securing a gold medal, Ray was appointed by the late Sir Asutosh Mookerjee (the Vice-chancellor) as a Lecturer. He found that he had to lecture to students

who on an average were older than himself and as such intially they tried to go in for some leg pulling but he dealt with them firmly and soon the students gave up their attempts. Simultaneously with lecturing he became a research scholar under the late Acharya Prafulla Chandra Ray. There was a great bond between the teacher and the pupil. Jnanendra Nath Ray used to keep his accounts, look after him and generally act as private secretary to the greatmen. The anecdotes about the absent-minded professor were many such as looking for the slippers and reading glasses which were often misplaced. As time went on, Jnanendra was influenced by Sir P. C. Ray's ideals of high thinking and simple living and self denial : Sir P. C. Ray used to call him one of his three *'Jnans'*.

Professional Career

After securing the Ghosh travelling fellowship he proceeded to England in 1923 to work with Sir Robert Robinson at Manchester which at that stage was the premier school for organic chemistry in Britain. The thorough grounding that Sir P. C. Ray imparted to his students at Calcutta now became obvious for he made rapid progress with his research work at Manchester. Sir Robert began entrusting a good amount of work to him and even asked him to help some of the other research workers. He worked with Professors Lapworth, W. H. Perkin and Robinson on the synthesis of berberin and brazilin. He received his Ph.D. for the papers published with Sir Robert Robinson. Amongst the work published was a paper in 1926 on the electronic theory of valency and aromatic substitution. This work received much acclaim.

Dr J. N. Ray also went to work with Dr Pregl at Graz in Austria on microanalytical chemistry which was then in its infancy. A few years later, the first laboratory on this field in India was set up at Lahore by him. On his return to Manchester from Graz, he received an honorary fellowship at the University. During his stay at Manchester he met Miss Dorothy Broadhurst whom he later married.

He returned to India at the termination of the Ghosh travelling fellowship in 1926 and rejoined Calcutta University briefly as a lecturer. Subsequently, he secured the Palit Scholarship and returned to Manchester in 1927 to continue working with Sir Robert Robinson there and later at Oxford. At the expiry of the Palit scholarship, Ray took up an appointment in Lahore with the Punjab University on November 15, 1928. Dorothy followed him to Lahore and they were married on December 29, 1928.

At Lahore, apart from lecturing in chemistry he also built up a thriving research school in organic chemistry. He also lectured in pharmacology at the Medical College and coached F.R.C.S. students for their examinations in this subject. He pioneered some of the work on alkaloids in India at Lahore and also worked on anaesthetics and chromatography.

Though he was a strict disciplinarian, he was humane towards his students. There were many poor and deserving students who not only were helped with their fees but also received financial help to buy books and travel to and from their homes

in the Panjab. After qualifying many students were helped in getting jobs and generally given a helping hand in life. In later years, it was very gratifying for him to see how well some of these students had done. He was also particularly pleased to know that the same research school he had helped to set up later produced a world famous chemist such as Dr Khurana who received the Nobel Prize in 1968.

In consideration of the papers published and work done in the field of alkaloids, he was awarded the D.Sc. also from Manchester in 1934.

At the outbreak of World War II, the Government of India found that they were in a serious predicament to the supplies of drugs, pharmaceuticals and dressings for military and civilian use which was hitherto, to a large extent, received from the U. K. With the outbreak of hostilities, the movement of these materials was restricted. The expansion of the fighting forces also created a futher demand for these supplies. The then Director-General of the Indian Medical Service, General Sir Gordon Jolly, visited Lahore in 1939 and asked Dr Ray whether he would be prepared to come over to New Delhi to take charge of a new department dealing with the manufacture of drugs, pharmaceuticals and dressings. This was an offer of challenge from the former which the latter felt was worth accepting. At the same time, he realised that it would mean giving up, at least for the War's duration, teaching and research which were so dear to his heart. As he felt duty-bound to do his bit for the war effort he accepted the assignment in New Delhi though he made it clear to the authorities that he would return to the University as soon as practicable.

On joining his assignment in New Delhi he had to put in a great deal of hard work, ingenuity and organisation. New units soon started providing the supplies needed for the War effort. Troops in the Middle East, Far East and Burma were now being supplied with products made in India for the first time and this must have given Dr Ray a certain amount of pride as he was a nationalist at heart. With reverses suffered by the Army in the Far East at the hands of the Japanese, the strain to meet fresh demands of these medical supplies increased and he put in longer hours at work to try and cope.

The Drugs and Dressings Directorate was later merged with the Industries and Supplies Department and J. N. Ray took the opportunity to set up in the new premises a small laboratory where he could work out some of the day-to-day problems. It was here that amongst others a special non-toxic camouflage cream for use by British troops against Japanese attacks was made. Work was done on anti-malarials and with the co-operation of the Vaccine Institute at Kasauli, dried blood plasma was used locally for the first time. An old women who was suffering from acute anaemia and on death's door was used as the human guinea pig of the Lady Hardinge College hospital in New Delhi. The product worked well and the pulled round. This incident he recalled to us later in his life. A few weeks before his own end, he suffered from acute anaemia and had to have five blood transfusions.

For his innovations he received cash awards from the government, the major portion of which he gave to his team of helpers. During the crucial years of the War i.e., 1942–44, he was consulted often by the British Government in London

and his advice and views were well respected. In 1944, he received the Q.B.E. and a letter of appreciation from the British Government for the work he had done.

The Industries and Supplies Department had by now grown into a large organisation which was also dealing with civilian requirements. J. N. Ray was on various committees, both technical and economic such as the Tariff Board.

As earlier mentioned, it was his intention to return to Lahore after the War, but he was requested to stay on in New Delhi to help in the Postwar Planning and Re-organisation. With the advent of partition it was no longer possible to consider returning to Lahore.

After independence, the work was linked more with planning, export and import control and policy making in relation to Industrialisation. He was associated with the basic planning done for the First Five Year Plan. In his capacity at Technical Adviser to the Government of India, J. N. Ray's advice was sought in various matters. Ray retired prematurely from the Indian Government. However, he continued to be their technical adviser. He joined a pharmaceutical firm in Bombay as he felt he could give his services better to industry. He was often consulted by the Government of India and he served on various advisory bodies. He was also the alternate leader of the Indian delegation to the ECAFE Council Meeting on Power Alcohol in 1952.

During his stay in Bombay, he was appointed honorary Professor of Chemistry at the University where apart from lecturing, he also guided research scholars for their doctorates. At Bombay, work on steroids was started and he personally made trips to locate the best source of supply for the raw material viz, the plant *Dioscorea.*

With his two children residing in Bengal, he felt an urge to return to the province and the environment from which he had been separated for so many years. He came to Calcutta in 1958 and took a new appointment with Messrs Calcutta Chemicals as their technical and research adviser. He was appointed Honorary Adviser to the West Bengal Government and the Durgapur Industries Board by the Late Dr B. C. Ray.

Other Interests

During his lifetime he took an interest in history and Archaeology and was on the Committee to preserve the Konarak temple and Elephanta Caves. He was an examiner and paper setter for the UPSC examinations. He was keenly interested in cricket and football and in his younger days often joined in a game of cricket with the friends of his son.

Honours

He was a past President of the Indian Chemical Society, the President of the Chemistry Section of the Indian Science Congress in 1937, Fellow of the Royal Institute of Chemistry of Britain and one time president of its branch in India.

Last Days

In 1967, he retired from his long career. After leading a very active and varied life he started living a quiet secluded life at home, seldom feeling the need to go out. In his own words, he stated that at this stage of his life *his thoughts were his best companions.* About a year ago, the symptoms first appeared of the illness to which he was to succumb on April 9, 1970. During the prolonged illness he bore the suffering with fortitude, calm and selfcontrol. In his passing on April 9, 1970 a great void has been left in our midst. The words of wisdom and advice which we used to take almost for granted will be missed, but cherished.

A Tribute

A senior chemist as well as friend of over 50 years standing, Professor Priyada Ranjan Roy said about him :—

"Kind largely compassionate in his friendship, Ray was ever ready to serve others in their need. A man of inflexible integrity and strict principle, he never yielded to pressures or prayers from any quarter, however high, for doing what he did not consider to be just and fair. Neither praise nor blame could deter him from the determined course of his action, for which he would even fight along against formidable opposition. He always used to work in the laboratory with his own hands in company with his pupils and assistants unlike many highly placed scientists who merely issue directions to their subordinates from their sitting room and seldom come into personal contact with their students. In this, he followed the example of his teacher Acharya Prafulla Chandra Ray and succeeded like the latter in building up a flourishing School of Chemistry in the University of Panjab at Lahore. Many of his students are now holding very responsible positions as teachers and administrators both in India and Pakistan. Ray had the courage of speaking out his mind without caring for the favour or frown from the authorities and thus set up an example which is unfortunately rare among the scientists today in our country. At the same time he was a great upholder of discipline among his students. He was an inspiring teacher and was liked equally by his colleagues and pupils. His conversation was always enlivened with the gift of his refined wit.

Simple in habit, frank in his disposition and warm in his dealing Ray will be remembered by all who came in contact with him not only as a distinguished chemist, but also as a man with rare qualities of the head and the heart. It needs hardly be mentioned that science in India has suflered a grievous loss by his death."

K. S. Narang

Note : This is one of the few cases of Fellowship for which the bibliography has been-unobtainable. —*Editor*

K. C Mukherjee

KSHIRODE CHANDRA MUKHERJEE

(1898–1971)

Elected F.N.I. 1953

KSHIRODE CHANDRA MUKHERJEE, the youngest son of Sri Jadab Mukherjee was born on February 8, 1898, in Malia-gram in the district of Faridpur (now in Bangladesh). He lost his father at the age of 7.

ACADEMIC CAREER

His early education was first in a local school and then in Rajbari, Faridpur. He obtained his First Class M.A. degree in Psychology and subsequently completed his work with the '*Premchand Roychand Scholarship*' winning the '*Mouat Gold Medal*'—a distinction in the Calcutta University.

PROFESSIONAL CAREER AND ACHIEVEMENTS

In his professional career, Mukherjee achieved the distinction of becoming Professor and Head of the Departments of Philosophy and Psychology in the Dacca University, in undivided Bengal. He was President of the Psychology Section of the Indian Philosophy Congress of 1947, where Dr S. Radhakrishnan, second President of the Republic of India was the general President. In 1937, he was President of the Psychology Section of the Indian Science Congress and President of the Joint Session of Physiology and Psychology Section of Indian Science Congress, both held in Hyderabad. His vast scholarship and his academic distinctions brought him wide acclaim. He became not only a Fellow (1953) of the National Institute of Sciences of India (now known as the Indian National Science Academy) but also a member of its Executive Council (1966–67). Almost simultaneously he was elected to the Fellowship of the Asiatic Society. His articles were published not only in the Indian Journals of repute but in journals of distinction published in U.K. and U.S.A. Professor Charles Myres, a renowned psychologist often spoke appreciatively of his work and Professor C. G. Jung, the great psychoanalyst made enthusiastic references to his work on *Tantras* and the symbolical significance of the *Mudras*.

Professor Mukherjee left Dacca in 1947 and joined the University of Calcutta. After retirement, he was recognized by the CSIR which supported him for some years. He developed a devoted band of workers around him, some of whom now enjoy acclaim and academic eminance.

His Views on Psychology and Education

Professor Mukherjee's views about education and the process of educating were pragmatic. He lead genuine interest in social service. He expressed his views in two articles : (1) "The social mind of the individual" published in the *'Indian J. Psychol* ; and (2) a Calcutta University publication on *"Sir Asutosh Mukherjee as a man."* These two important articles outline his thinking about education and the process of educating. The first article contains a theoretical analysis. He said, *"man is a social being, who actually believes in sympathy, cooperation and understanding for his community living. It is tolerance and inter-dependence which can make the living happy and creative."* Thus, *"We have in society also many disruptive forces working against such principles, but we have hold patience and have to get into them also. We have to hear them and discuss their views also "* This was indicative of his liberal outlook. Professor Mukherjee thought that society needed to be permissive. But it was also to be a just society and a creative one. An individual had to be of the highest service to society, firstly by offering his services to society, secondly, by communicating his thoughts, ideas and experiences and thirdly, by giving a practical demonstration of his thinking. But individual needs, moods, wishes, and desires are highly variable. They often are in conflict leading eventually toward the destruction of society through ward and other violent activities. Professor Mukherjee felt that this was harmful and violence had to be avoided at all cost. In society, every human being has equal rights and opportunities to live and let others live. As a psychologist, he was deeply concerned about the preparation of better minds for a better society—a difficult task. It was due to the absence of a large number of better minds, he felt, that the world passed through critical periods. The experiences of the past should put the social mind into introspection and self-analysis. He was optimistic about the future and presumed that better days were not far away.

An Educationist

As a pragmatist, he was of help to the poor. He remodelled the West-End High School in Dacca, providing it a new building. For this purpose, he went from door to door for public donations. He asked the Government also to help in this a noble pursuit. His sympathy went for the deaf and dumb also. He was a joint Secretary of the Government Hindu Orphanage at Dacca and a member of the Governing Body of the Government Deaf and Dumb school there. Later on, when he came to Calcutta, he was associated with similar institutions.

Professor Mukherjee's views on University education was clear and forthright. He felt that only academicians with first class qualifications had a place in the University. Otherwise it would create people with pseudo-intellectualism. Professor Mukherjee's own unpleasant experiences could have made him visualize the situation in this way. But he was not wrong. When the new departments were opened in Calcutta University, Sir Asutosh Mukherjee, its Vice-Chancellor appointed

a band of young men with first class academic careers with vision and creativity to University positions, many of whom raised the status of the University.

Professor Mukherjee was interested in the relationship between Science and Religion. He believed that religious beliefs and practices had little to do with the real purpose of religion. On the other hand some of them had perhaps undermined the scientific foundations of religion and its purpose. Professor Mukherjee was, by training, a scientist but by being associated with philosophical thinking, he was able to attempt a study of religion from the scientific standpoint. His advocacy of Sir Oliver Ledge's thesis on telepathy, was perhaps an outcome of this thinking. He also identified himself with Professor William James in regard to mysticism and religion and preferred to interpret that to be a perfectly religious person, one had also to be perfectly scientific.

Professor Mukherjee was not only a sound theoretical psychologist; he also had a flair for instrumentation for use in experimental psychology. He designed in 1935 the 'Mukherjee Aesthesiometer.' The instrument was manufactured by Steelting & Co., U.S.A.

Continuous academic exercises outweighed the capacity of his health, specially paralysing the brain functions. He entered into a coma and was laid senseless. Professor Mukherjee died in Calcutta on January 21, 1971 at the age of 73. He is survived by his wife, three sons and two daughters. His son, Dr Sankar Mukherjee is a mechanical engineer. The present author is deeply grateful to him for providing all the information recorded here.

B. MUKERJI

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LAKSHMESHWAR RAMA RAO

(1896–1974)

Elected F.N.I. 1939

Early Life and Education

Lakshmeshwar Rama Rao was born in Bangalore on March 23, 1896 which happened to be *Sri Ramanavami*, the ninth day of Chaitra, a day held in great veneration by the Hindus. His father, L. Raghavendra Rao Deshpande, appropriately named his son "Rama". Rama Rao lost his mother Nagu Bai when he was only seven years old. He had his early schooling in the school at Sultanpet, close to the place where his parents lived. He later studied at the Fort High School, Chamarajpet.

Even at a young age, Rama Rao was acclaimed as a debator and won many prizes. Later, along with his brother Swami Rao he became an active member of the Friend's Union, a leading literary and debating Society of those days. He graduated from the Central College (then affiliated to the Madras University) in the year 1918 and soon after joined the Geology Department of the College as a demonstrator. While still a teacher he secured the M.A. degree in Geology, of the Calcutta University, in the year 1924.

Teacher of Geology, Central College

For nearly 35 years, first as a lecturer and later as Professor of Geology, it was given to Rama Rao to train a large number of students in geological science and instill in their minds a genuine love for the subject. He lectured mostly on dynamical geology, palaeontology and stratigraphy. His lectures used to be of absorbing interest. His was an effortless exposition and words flowed in a lucid manner. He was a lover of choice expressions. He used the black board liberally to write down all new terms. His writing was clear and quite characteristic. The sketches he drew were neat and illustrative. In short, he did not merely lecture, but taught. He was an excellent teacher.

Research Work at Central College

Early in his teaching career, Professor Rama Rao developed a keen interest in the study of the Cretaceous rocks of Trichinopoly which were known to be full of

L. Ramakan.

organic remains. He kept up a sustained interest in the study of these rocks and published over 100 research papers dealing with various aspects of the subject. The more important of these relate to "The discovery of fossil algae in the South Indian Cretaceous" (*Nature*, 1932), "On the fossil algae from the uppermost Cretaceous beds (the Niniyur group) of Trichinopoly Dt., South India" (*Mem. geol, Surv. India, Pal. India*, 1936); "Recent discovery of fossil algae in India" (*Birbal Sahni Memorial Volume*, 1952); "Fossil Forminifera from the Cretaceous rocks of South India, Ariyalur area—Orbitoides" (*Proc. Indian Acad. Sci.*, 1957); "Fossil algae in India" (*Nature*, 1958); "The problem of the Cretaceous-Eocene boundary" (*Proc. natn. Inst. Sci. India*, 1960).

Professor Rama Rao was fortunate in having a small team of active workers who appreciated the zeal with which he pursued palaeontological research and gave him their full cooperation in making detailed investigations. The Geology Department of the Central College in those days was a well-known centre for research and attracted the attention of such noted scientists as Professor Birbal Sahni and Sir C V Raman.

Professor Rama Rao's regret, to which he often gave expression, was that a field of study of such great interest and on which so much work was being done outside India was so sadly neglected in our Universities.

The study of the Cretaceous-Eocene boundary which he initiated has now assumed global significance. Professor Rama Rao organised a symposium on this subject at Bangalore in June 1966, when leading workers from different parts of India presented the results of their research. Realising the importance of the new data which came to light at the symposium, he edited the proceedings and brought out a bulky volume entitled "*Cretaceous Tertiary Formations of South India*," which forms a notable contribution to Indian Geology and which is a tribute not only to his scholarship but also to his ability in bringing out the best in his students.

His main thesis was that no definite line really separates the two major eras. The concern of stratigraphers should be to discover more possible 'no boundary' areas and to reconstruct and present a continuous and unbroken record of geological and biological events. Professor M F Glaessner, the noted palaeontologist from Australia, considered the review presented by Rama Rao as one bringing together a wealth of data which must be considered by every geologist and palaeontologist connected with the problem. The work does not pretend to find an answer to the problem. It shows why no simple answer can be distilled from published data alone. The particular merit of the paper lies in its clear indications, particularly to workers in the Indian region, of the most important studies to be undertaken in the field as well as in the laboratory to fill vital gaps in our knowledge and in its conclusion which presents an equally clear statement of sound principle to be applied to problems of boundaries in the stratigraphic scale in relation to Earth History.

One of the important discoveries to the credit of Professor Rama Rao was the discovery of fossil algae from the Niniyur beds of South India. His studies were published as a special Memoir of the Geological Survey of India (*Palaeontologia Indica*) under the joint authorship of himself and Professor Julius Pia. The Niniyur

Group was identified by Rama Rao as a distinct stratigraphic unit in the Cretaceous-Tertiary succession of South India.

Service to the Geological Society of India

In 1958, Professor Rama Rao led a select group of enthusiasts in Bangalore who felt the need for a well-organised Geological Society of India, devoted to the task of promoting the cause of advanced study and research in all branches of Indian Geology. As Chairman of the Steering Committee he, took the lead in the formation of the Geological Society and secured for it the cooperation and support of almost all leading geologists in the country.

Professor Rama Rao had realised that the surest way of achieving the objectives of the Society was to bring out a Journal containing the best work done in the country in the field of Earth Sciences. For an unbroken period of 15 years from 1958 onwards till his death in 1974, he toiled hard to build up the Journal. Thanks to his unremitting effort, the *Journal of the Geological Society of India* came to be ranked as one of the leading scientific journals in the country. The starting of this Journal, tending it and acquiring for it within a few years of its start, an unrivalled status and reputation, were his great achievements and gave him great satisfaction.

In his editorial work he set a very high standard. He chose only the best, discarded the ordinary, but never forgot to encourage the young aspiring worker taking his first steps at scientific writing. He rose above provincialism and preserved the all-India character of the Society. Because of his dedicated work, he came to be held in great respect and veneration by geologists in the country.

The work he did for the Society was a labour of love. Those who are not in the know of things cannot have an idea of the amount of work involved in editing, proof-reading and publishing a scientific journal and bringing it out on time. This labour would have daunted a much younger man, but Professor Rama Rao undertook this work willingly, although he was nearly 65 years when he took on this job and discharged it with singular distinction. He was sparing in his correspondence and acted on the principle that an editor is not to be seen or heard but to be felt. This dedicated work for the Journal, carried out in all sincerity and without expectation of reward, was amply compensated by the encomium showered on him by the Fellows of the Society. This was a matter of great satisfaction to him. His stewardship of the Journal was a 'disinterested endeavour to learn and propagate the best.'

Awards and Honours

Professor Rama Rao became the head of the Geology Department of the Central College in the year 1933 and held that position for 20 years. He was a Foundation Fellow of the Indian Academy of Sciences and also edited Section B of its Proceedings. Professor Rama Rao discharged his work as Editor with great

distinction. The National Institute of Sciences (now the Indian National Science Academy) elected him as a Fellow in 1939. The Indian Science Congress elected him as President of the Geology Section in the year 1940. The Asiatic Society of Bengal awarded the *Pramatha Natha Bose Medal* to him for outstanding contribution to practical geology with reference to Asia, particularly in the fields of stratigraphy and palaeontology. He came to be recognised as a leading authority in the study of the Cretaceous-Tertiary boundary problem and was invited by the U.S.S.R. Academy of sciences to be member of the working group appointed for dealing with this subject on a global basis.

Private Life and Character

As a man, Rama Rao was very simple but highly principled. He led a regulated life. There was a time for everything and he refused to budge from the strict time table he had set for himself. He did not easily mix with people and had very few close associates.

Professor Rama Rao was not ambitious in the worldly sense. He was content with what came his way and never sought fame or wealth. In 1956, when the newly organised Oil and Natural Gas Commission was formed, the need for a high calibre educationist to take charge of the training of probationary geologists and geophysicists was felt. The Commission was anxious to obtain the services of Professor Rama Rao as Director of Training, and offered him the maximum salary the Commission had the authority to offer. But he declined the offer. In later years, when a choice was placed before Professor Rama Rao of becoming the President of the Geological Society of India or continuing as Editor of the Journal, he unhesitatingly chose the drudgery of editorship to the honoured place of the President.

Professor Rama Rao was not given to taking quick decisions. He deliberated on every issue for a long time before taking action. He did not easily trust others and tried to do everything himself. He had formulated his own code of conduct and adhered strictly to it unmindful of the impression he created.

Last Days

His 75th birthday was performed as usual on Sri Ramanavami day in the presence of his children and grand children. He was apparently in quite good health. On July 11, 1974, he had a sudden stroke which paralysed the right side of his body. He however rallied and showed slow but steady improvement. There was a sudden setback on the afternoon of November 11, 1974 from which he did not recover and passed away peacefully. His funeral was simple. There were no crowds. Only about half-dozen of those close to him were at the crematorium. His end was as unostentatious as his life.

Professor Rama Rao will be remembered for years to come for the important role he played in the development of Indian geology as a great teacher, as a

dedicated researcher, but more than these, as the Founder of the Geological Society of India and as its Editor.

B. P. RADHAKRISHNA

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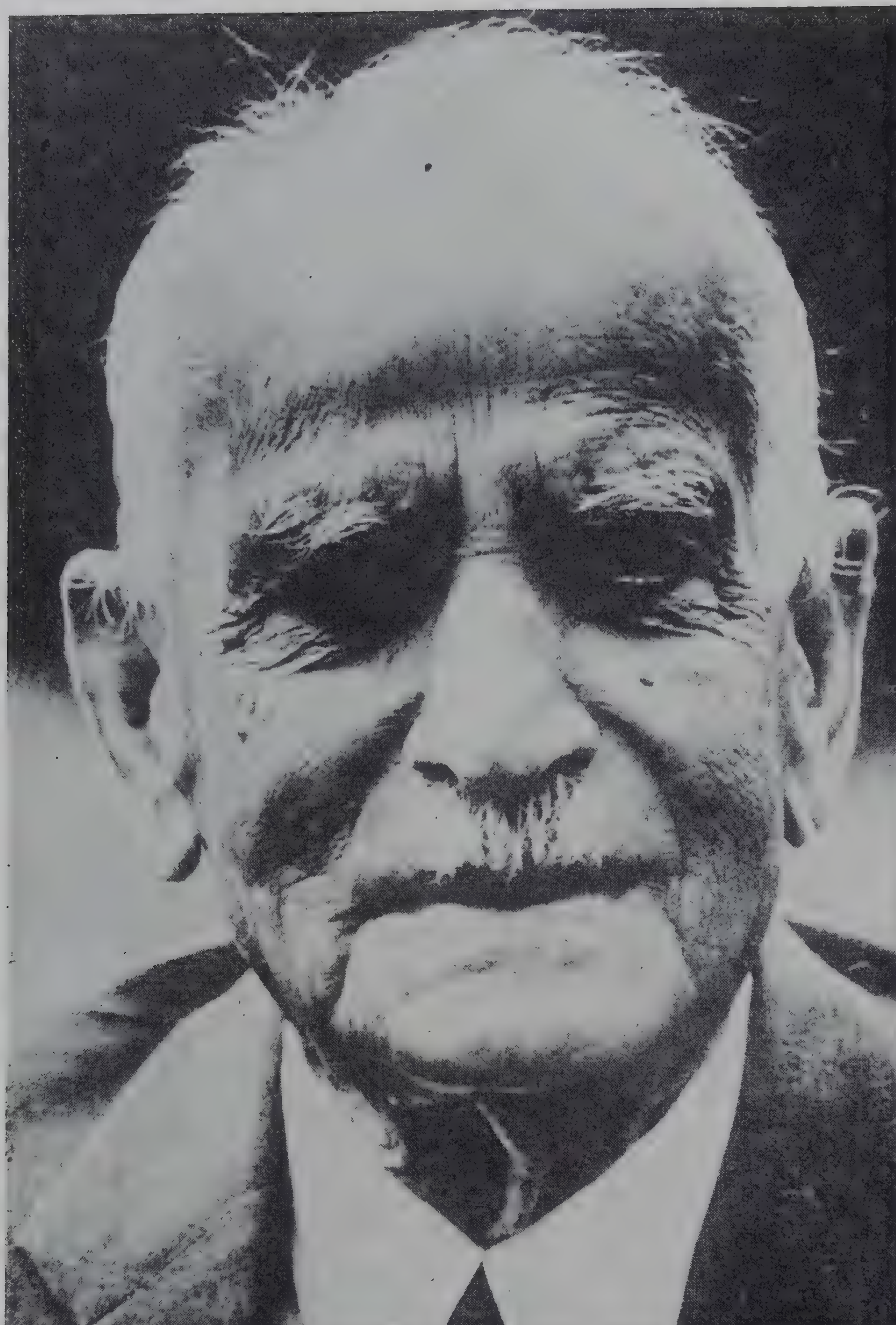

VISHWA NATH

(1897–1976)

Elected F.N.I. 1940

Birth, Parentage and Education

Vishwa Nath was born at Amritsar on 9th July, 1897. His father—Pt. Baij Nath, who had studied up to only the 8th class, was a man of vision and a pioneer in the field of education, being probably the first individual to start a school in Amritsar, with just a few students in the beginning. Early in the morning, he would collect them from their homes and after a few hours of drill and play, would coach them himself and would then go on his round again, dropping each one of them at his respective place. Thus, Pt. Baij Nath's School gradually became a very popular institution and the number of students also increased considerably. It soon became a middle school and within a few years it was raised to be a high school. The importance of sports in the education of a child was a conviction with Pt. Baij Nath. Being a very keen player himself, he organized cricket matches with the teams of the princely states of Kapurthala and Patiala. He accompanied these teams himself and took a personal interest in the activities of all his students.

Vishwa Nath was the youngest of the three brothers and a favourite of his father, who saw in him the potential of a keen student and sportsman. Unfortunately, however, the guiding hand of the father was available to Vishwa Nath only for 10 years. His father's illness for three months, resulting in the loss of speech and paralysed limbs, shocked the young boy. His father's death and the rituals, which he recalled with horror till his old age, left an indelible mark on his sensitive mind and were responsible for the nightmares he used to suffer till he became a devotee of the Gita in his fifties. The loss of his father and that of his mother, a few years later, made him an orphan. The school also suffered because of the inexperienced management of his elder brother—Pt. Ram Nath, but was rescued by a close associate of the family—Shri Ram Rattan, who created a trust to run it. Today, it is the largest school in Amritsar.

Vishwa Nath's schooling was in his father's institution and, after completing his Matric, he joined the Government College at Lahore as (now in Pakistan) a science student. In the enlightened atmosphere of this college, his personality began to flower and the early influence of his father began to bear fruit. In fact, he became a unique combination of a scholar and a sportsman Besides being a member of the college team, he was also selected to be in the Punjab University cricket team. His talent in

cricket soon attracted the attention of the late Maharaja Bhupinder Singh of Patiala, who offered him the post of Professor of Zoology at the Mohindra College, Patiala, while he was still in his fifth year. He carried the letter of appointment in his pocket for a year and in the year 1920, he joined the college at the age of 23. For the next three years he devoted himself in setting up a research laboratory in the college and bringing credit to the State in various cricket matches.

Higher Education

Vishwa Nath joined the Trinity Hall at Cambridge in 1923 and completed his thesis entitled "Cytology of the reproductive organs of scorpions and mosquitoes" under the direct supervision of Dr James Gray in the record period of two years. This was actually approved for the Ph.D. degree of the University of Cambridge on June 16, 1925. He had, of course, been publishing research papers, while he was still at Patiala. When studying abroad, he was also selected for the University cricket team and, thus, became a Cambridge blue. Though he lived frugally in digs, yet he had to incur a loan from a family friend at Amritsar. On his return to Patiala in 1925, the Maharaja gave him Rs. 15,000 for his expenses in England and he was happy to repay the debt which had been troubling his conscience. In 1927, Dr Vishwa Nath was selected as a Lecturer at the Government College, Lahore. Here he dedicated himself to his research work and also organized the Panjab University Cricket Association of which he was the President for many years.

Personal Qualities

The qualities of character which were responsible for his success were tenacity and perseverence in any task that he undertook, an unprejudiced, open and inquiring mind and simplicity coupled with humility. He had no guile and spoke out his mind which sometimes irked those who came in contact with him. But his sincerity soon won over his students and colleagues alike. Once, while he was the Principal of the Government College at Hoshiarpur, he unjustly reprimanded one of the teachers. It was late in the evening when he learnt of the real facts and realized his mistake. He could not, therefore, rest and went immediately to the house of the aforementioned teacher to apologize and beg for his forgiveness. He found strength in solitude and nature. He took his family to Pahalgam in Kashmir almost every year during the vacations and all his children recall with nostalgia the long treks and walks he undertook with them. He was a contented man and thanked God for all his mercies many times in the day. One day, during his usual microscopical study of the cell, it occurred to him that he was looking at only the dead material and it set him thinking about the actual life force which made that cell alive. This spurred him to the study of the Gita which seemed to answer all the questions he had in his mind. He, therefore, memorized the entire Gita in two years—1950 and 1951 and started the Gandhi prayer class in the Government College at Hoshiarpur. With his characteristic steadfastness, he recited the whole of Gita every day without ever missing it even for a single day. Sometimes, when he was behind schedule, he would

refuse to see visitors much to the annoyance of his wife who thought that be would be considered as anti-social. But he would not relent because, once he resolved to do something, there was no question of his leaving it half done. His children have a recording of his recital of the entire Gita.

His Sudden Demise

On June 2, 1922, Dr Vishwa Nath got married to Jashodha, the daughter of aneminent businessman—Pt. Mohan Lal, who helped him to realize his ambition of doing his Ph.D. from Cambridge. He owed much of his success to his wife who took over the management of the household and the children completely. When she passed away in 1975, he lost the will to live. Their was a silent companionship which comes after years of understanding. On December 19, 1976 he went out for a morning walk in Delhi where he had gone to watch the cricket match between the MCC and India. He was perfectly hale and hearty and the doctors had declared him quite fit only a few weeks earlier. He was accompanied by his eldest son-in-law, Mr Krishan Rai. He suddenly looked at the Sun and exclaimed, "Ah what a glorious Sun !" He took a few more steps and said, 'Krishanji', put his hand on his heart and collapsed. His sudden, yet enviable, death left his immediate and larger family of students stunned and bereaved. Letters of condolence poured in by the hundreds from all over the world to the members of his family and to the writer of this biographical memoir, who happens to be not only his pupil and the first Ph.D. student, but also his successor to the Chair of Professor of Zoology in the Panjab University which Dr Vishwa Nath had occupied with distinction from 1952 to 1959.

Contributions

Dr Vishwa Nath was working as a Lecturer in Zoology at the Government College, Lahore (now in Pakistan) when the present writer had joined that great institution in the year 1934 as a student of the first year class. At that time, Dr Vishwa Nath used to teach Zoology to the students of the Intermediate classes and for his lecture notes he used to have the proofs of his famous book—*Zoology for Intermediate Students* which came out in 1936. For the B.Sc. students, he used to run a special course of lectures and practicals on Protozoa in the summer of every year. The B.Sc. class at the Government College, Lahore used to be open to Zoology students of all the local colleges affiliated to the Panjab University and, thus, the number of students in it was fairly large. There was, therefore, no question of any close contact between the teachers and the taught. In fact, almost all the teachers of that college used to keep themselves aloof from their students.

Besides teaching, Dr Vishwa Nath was fairly active in research, though no encouragement was given to him for the same. He used to travel to far off places like the Krusadai islands in the South and Karachi (now in Pakistan), to collect material for his researches. As a result of these, he had already published a large

number of papers the most prominent of these being "The spermatid and the sperm of the crab, *Paratelphusa spinigera"* which appeared in the *Quarterly Journal of Microscopical Science* in 1932. Dr Vishwa Nath had clearly shown in this paper that the sperm of this animal, in spite of its queer form, is exactly like a typical flagellate sperm with regard to its components. Since Dr Vishwa Nath was very fond of taking tea, he compared the nucleus of this sperm with a tea cup with the margin of which the ring-like acrosome is fused just like its golden lace. The cavity of the nuclear cup is completely filled up by the mitochondrial vesicle at the bottom of which lies the vesicular 'proximal centrosome', the mouth of the nuclear cup being efficiently plugged by the ring-like, 'distal centrosome'. The two centrosomes are joined together by a thick axial filament.

Dr Vishwa Nath also produced evidence to demonstrate that the spermatozoon explodes at the time of fertilization and its weird form is now transformed into that of a typical one.

This paper was followed by another on "Spermatogenesis of the prawn, *Palaemon lamarrei"* which was published in the Journal of Morphology in 1937. Dr Vishwa Nath, being a great cricketer himself, had homologized the sperm of this animal to a cricket ball, the outer leather covering of which represents the nucleus, the internal stuff being the cytoplasmic vesicle, formed by the whole of the cytoplasm containing the entire mitochondrial and Golgi material. The hole at the top of the cricket ball is plugged by a ring-like centrosome, which gives off inward a large number of axial filaments radiating through the cytoplasmic vesicle and outward a long and stout spine. Since both of these structures were outgrowths from the centrosome, Dr Vishwa Nath had further homologized them with the axial filament of a typical flagellate sperm. The acrosome in this material is not formed at all as the whole of the Golgi material is completely merged along with the mitochondria into the cytoplasmic vesicle. Finally, Dr Vishwa Nath had suggested that, just as in the crab, *Paratelphusa spinigera,* the cytoplasmic vesicle of the sperm in the prawn, *Palaemon lamarrei* also provides the mechanism which is responsible for its explosion at the time of fertilization.

Honours

In recognition of his researches, Dr Vishwa Nath was elected a Fellow of the then National Institute of Sciences of India (Now the Indian National Science Academy) in 1940. Two years later i.e. in 1942, Dr Vishwa Nath published a comprehensive monograph on *The Decapod Sperm* in the *Transactions of the National Institute of Sciences of India.*

It was only towards the end of this year that Dr Vishwa Nath was promoted to the Chair of Professor of Zoology in the Government College at Lahore which was vacated by Dr George Matthai who had occupied it with great distinction since 1919. Dr George Matthai was simultaneously the Professor of Zoology in the Panjab University.

Early in the month of January, 1944, Dr Vishwa Nath presided over the Section of Zoology of the Indian Science Congress held at Delhi and delivered his now famous address on 'The Golgi Apparatus'.

As a result of his brilliant researches, which were from now on published mainly in the Research Bulletin (Science) of the Panjab University, Dr Vishwa Nath was awarded the Sc.D. degree of the University of Cambridge early in 1959. He was also an Emeritus Scientist of the Council of Scientific and Industrial Research of the Government of India.

In 1968, Dr Vishwa Nath was awarded the Joy Gobinda Law Memorial Gold Medal by the Asiatic Society, Calcutta for outstanding research in Zoology

Services to Science and Education

In 1947 the country was partitioned with the result that the Panjab University, as a whole, was handed over to Pakistan. Consequently Dr Vishwa Nath, who had also been working as Director of the Panjab University Zoological Laboratories at Lahore, had to shift, like many others, to this side of the border. To begin with, he was appointed Principal of the Government College at Dharamsala (now in Himachal Pradesh), but he was there only for a few months. On March 1, 1948, he joined the Government College at Hoshiarpur and within a month of his taking over as the Principal of this college, the Department of Zoology of the then East Panjab University started functioning in one of the verandahs of this college. So far as the equipment was concerned, initially there were only two microscopes, an ordinary rocking microtome and an old embedding bath which had probably been purchased for the Department of Zoology of this old college by his equally prominent and well known predecessor—Dr B. L. Bhatia, who was the Principal of this college from 1927–37.

Soon after Dewan Anand Kumar, who had been a Reader in Zoology and also the Dean of University Instruction at Lahore, was appointed the Vice-Chancellor of the East Panjab University. Since Dr Vishwa Nath had his full support, he was successful in persuading the Panjab Government to provide within a few years a first class two storeyed building at Hoshiarpur to house the Departments of Zoology and Botany. In 1952, however, Dr Vishwa Nath retired from the Government service and joined the Panjab University as a whole time Professor of Zoology. It was mainly due to his own initiative and active interest that more of equipment, in the form of Phase Contrast and Interference microscopes, was added of course with the liberal grants from the Government and the University Grants Commission. As a result of this, the quality of research gradually improved and simultaneously with the addition of more staff even the output of research reached its peak. Dr Vishwa Nath, had, therefore, rightly started at this time the publication of Research Bulletin (Science) of the Panjab University. To begin with, every research paper was published as an independent number of this Bulletin. But gradually, with more of research papers coming in, the Bulletin matured into a regular and quarterly research journal, publishing a full volume of four parts—the Parts I and

II, bound as one, were out in the month of June and similarly bound Parts III and IV were out in the month of December every year.

At the end of the month of September of 1959 Dr Vishwa Nath retired again, this time, of course, from the service of the Panjab University. He, however, continued as Chief Editor of the Research Bulletin (*Science*) in an honorary capacity. But even this he had to relinquish in 1963 as he had accepted his appointment as Professor and Head of the Department of Zoology in the newly created University at Jodhpur. There also he had created an active school of research in cytology which was so dear to his heart. After being away for about two years at Jodhpur, Dr Vishwa Nath returned to the Department of Zoology of the Panjab University at Chandigarh as Professor Emeritus—a title conferred on him by the Panjab University on account of his meritorious services to the University. Dr Vishwa Nath had been a Fellow of the Senate and member of the Syndicate of the Panjab University for a number of years. For quite some time he was also the Dean of the Faculty of Science and Mathematics in this University.

A Prolific Writer

Dr Vishwa Nath was a prolific writer. Besides research papers, he also wrote *A Text Book of Zoology* for the B.Sc. students. Whereas the first volume of this book, dealing with the Invertebrates, came out in 1961, the second on Chordates was published in 1964. Both of these were dedicated by him to the memory of his father.

In 1965, the Asia Publishing House brought out Dr Vishwa Nath's most important monograph on *'Animal Gametes (male)'* which he rightly dedicated to the memory of Jawaharlal Nehru—the king among scientists and the Architect of Resurgent India. In this monograph Dr Vishwa Nath has recorded a morphological and cytochemical account of spermatogenesis in a large variety of animals, both from the Invertebrates and Vertebrates, studied either by him or by his students and colleagues during the last forty years or so in the Department of Zoology of the Panjab University, first at Lahore and then at Hoshiarpur and Chandigarh with only light microscopes. He has also attempted successfully to correlate his findings with those of the electron microscopists.

A similar monograph on *Animal Gametes (female)* was published by him in 1968 which he dedicated to Professor Sir James Gray, Kt., F.R.S., in commemoration of his 75th birthday and his many distinguished years of service to the University of Cambridge as a Doyen of Zoology. It will be recalled that Dr Vishwa Nath had worked under his direct supervision when he was carrying out research for his Ph.D. at Cambridge.

Dr Vishwa Nath had also published a small book entitled *Cell Biology* in the year 1970. This was dedicated by him to all his pupils. In this book and the monographs are recorded the considered views of Dr Vishwa Nath on such important cell inclusions as the mitochondria, Golgi elements, centrioles, chromatoid bodies and nucleoli etc.

In almost all his publications, Dr Vishwa Nath has been laying great stress on the vesicular form of the Golgi body. Each vesicle, according to him, is provided with an osmiophilic and argentophilic cortex and an osmiophobic and argentophobic medulla. To begin with, however, the Golgi body is granular, but soon it is differentiated into a duplex or binary vesicle. These observations of Dr Vishwa Nath have been fully supported by the histochemical studies made by him and his collaborators.

In many of his publications, Dr Vishwa Nath has also figured a few crescent-shaped Golgi elements. Each of these has a chromophobic sphere attached to its concave side. These dictyosomes were also interpreted by him as tagential sections of the duplex Golgi vesicles.

Right from the beginning Dr Vishwa Nath has been collecting suitable evidence to support his view that the fatty yolk in eggs is directly formed from the Golgi vesicles of the earlier stages by a gradual process of growth of these vesicles, an attenuation of their rims and deposition of fat in them. Histochemical studies made by him and his collaborators fully support this view.

Dr Vishwa Nath has also fully established the presence of R. N. A. in the mitochondria. This clearly indicates that they are also needed in protein synthesis. In fact, in many of his publications he has shown them to grow into the protein yolk directly.

It will, thus, be seen that Dr Vishwa Nath was the foremost cytologist of the country and he created around him, wherever he had worked, an active school of research for such studies. As a result of these, many of his students are now occupying positions of responsibility in various Universities of the world.

Acknowledgements

Two of Dr Vishwa Nath's brilliant students namely Dr Brij L. Gupta of the University of Cambridge and Dr Sudarshan K. Malhotra of the University of Alberta at Edmonton (Canada) have been kind enough to provide the necessary material for this memoir and its writer is, therefore, very much obliged to them for the same. Similarly the information provided by Dr Sarla Kumar on behalf of Dr Vishwa Nath's daughters is also gratefully acknowledged.

G. P. Sharma

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ANANT GOPAL JHINGRAN

(1908–1977)

Elected F.N.I. 1954

Birth and Childhood

Anant Gopal Jhingran was born on August 12, 1908, at Amroha in Uttar Pradesh. His parents were, Lal Gopal Jhingran, a leading lawyer of the district and Radha Rani. Lal Gopal Jhingran was Secretary of the Local School where Anant Gopal commenced his primary education at the age of five. His childhood was marred by the sudden and unfortunate demise of his father, who became a victim of the 'Flu' epidemic of 1918 at the young age of 45. His father left besides Anant Gopal, two other sons and three daughters. Anant Gopal Jhingran was the fourth child of his parents.

At the time of his father's death, Anant Gopal Jhingran's elder brother, the late Vansh Gopal Jhingran, formerly Principal, D. S. College, Aligarh, was only eleven years old and his younger brother, Vishwa Gopal Jhingran (retired as Director, Central Inland Fisheries Research Institute, Barrackpore) was still to be born, posthumously. The untimely tragedy caused by the father's death deprived the family of the only source of support and the burden fell on the mother. The family later migrated to Lucknow to reside with their grand uncle and subsequently to Calcutta, where the mother earned a modest living, by teaching sewing and embroidery in a girls' school to support herself and the family.

Education

Anant Gopal Jhingran passed the School Leaving Certificate Examination in 1924, in the first division with distinction in Mathematics. In recognition of his brilliant performance, he was awarded a merit scholarship by the U. P. Government. The scholarship, supplemented by earnings from private tutions, enabled him to carry out his studies at the Intermediate Science level. His boyhood dream was to become a medical graduate so as to amelionate human sufferings and accordingly, he selected the Biology group for studies. However, after passing the Intermediate examination, he had to reconsider his earlier decision because of the financial position of the family, which could ill afford the comparatively expensive and time-consuming medical education. He finally gave up the idea of becoming a medical graduate and decided to take up studies in the comparatively new field of Geology, for which he developed a liking through his American teacher of Chemistry, Mr Tweedie,

A. C. Jhingran

at the Lucknow Christian College. The crystals and minerals which Mr Tweedie showed made a deep impression on his mind and inspired him to study them professionally in an intensive manner.

There was on facility for the study of Geology at the Lucknow University at that time. In fact, there were only two centres, Calcutta and Banaras, for study of Geology in North India. He accordingly decided to move to Banaras. The Banaras Hindu University was a great national institution and enjoyed international reputation. Students from all parts of the country thronged to this University, but only the most talented and meritorious could hope to get admission there. His going to Banaras involved further financial commitments which young Jhingran met through merit scholarships, private tutions as well as through odd part-time clerical jobs.

Jhingran passed his B.Sc. examination in 1928 and M.Sc. in 1930, securing a first division in both and also the first rank in the latter. At this stage, he appears briefly to have entertained the idea of joining the Indian Civil Service. He, however, gave it up, having been influenced by the intensely nationalist outlook prevailing at that time in the country.

Professional Career

Based on Anant Gopal's outstanding academic record, he was offered, soon after obtaining his M.Sc. degree, the post of Demonstrator in Geology in the then Mining and Metallurgy Department of the Banaras Hindu University. This was the beginning of a career of distinction, as a teacher, researcher, explorer, writer and scholar. He was also keenly interested in extra-curricular activities and had considerable histrionic talent; he was closely associated with the Drama Society of the Banaras Hindu University, of which he was also the Secretary. His creative mind manifested itself in several ways. His new year greeting cards depicting sketches on the life, work and aspirations of earth scientists are remembered by all. He was honoured many times by the T. B. Associations of West Bengal and Delhi for helping in their annual T. B. Seal sales campaign.

In 1936, Professor Jhingran decided to seek admission for his doctoral work at the Imperial College of Science and Technology, London. Though he did not get a firm commitment for admission, he took the grave risk of reaching London before the session was to commence. For this he had to arrange personal loans from various sources. However, he could not obtain admission in the Imperial College. Meanwhile, he went to the late Professor Arthur Holmes of Durham University, who advised him to get himself admitted at New Castle-on-Tyne as a Ph.D. student to work under Professor S. I. Tomkeieff.

He paddled a bicycle as a field transport, since there was no transport facility in his research area and enrolled himself as member of Youth Hostel Associaton and International Cycle Association. After completing his doctoral work, on his way back home in 1938, young Jhingran decided to pedal through Europe. He crossed the North Sea from New Castle-on-Tyne to Oslo in Norway in a steamer and

travelled across Europe to Munich on a bicycle in two and a half months, cycling on an average of 80 miles a day—indeed a feat of determination, stamina and perseverance.

At the Geological Survey of India

On his return from England in 1938, he resumed his position in the Banaras Hindu University. Subsequently in 1939, promoted by an urge for investigating the vast unexplored mineral resources of the country, he joined the Geological Survey of India as an Assistant Geologist, where he served with great ability and dedication for 27 years and occupied various positions and shouldered many responsibilities. He rose to a high position and finally retired in August 1966, on attaining the age of 58 years, as its Director-General.

At the Delhi University

When Professor Jhingran was about to reach the age of superannuation in the Central Government service, the University of Delhi decided to organise a Department of Geology in its Faculty of Science. Dr C. D. Deshmukh, the then Vice-Chancellor of the University, invited him to establish the new Department. Thus, he joined the University as the founder Professor and Head of the Department of Geology on the November 2, 1966. This brought him back into the academic field, which he had given up in the late thirties (1939) when he left the Banaras Hindu University to join the Geological Survey of India. Although, while in the Geological Survey of India, he had delivered a series of lectures on Geology for about a month in the Forest College, Dehradun, in 1942, and occasionally taught, as a part-time, teacher in 1947–48, at the Presidency College, Calcutta, his return to teaching on a full-time academic assignment at the Delhi University was a matter of great personal satisfaction to him.

The Department of Geology at the University of Delhi, officially started functioning from the November 2, 1966, the date on which Professor Jhingran joined the University. However, it required a great deal of preparation and planning. Space had to be found for setting up the laboratories and classrooms, equipment had to be procured, staff had to be appointed and syllabi formulated. By dint of imaginative but realistic planning, Professor Jhingran assisted by V. K. Verma (the senior author), then the only other member of the teaching staff and his immediate successor, carried out the initial preparations within a period of 8 1/2 months. It enabled the University to admit the first batch of students for the three year B.Sc. Honours course in July 1967. The Department, under the stewardship of Professor Jhingran, grew within a period of seven years to notable proportions and became an established centre for teaching and research in the country. Professor Jhingran, retired from active University service on August 12, 1973, the second retirement of his life. As Professor F. J. Pettijohn (John Hopkins University, U.S.A.) put it : *"I salute you on the occasion of your retirement—a second retirement—this one from academic life, the first one from the Government service. May you have many*

more retirements." Even after his retirement, he continued his association with the Department of Geology and was later appointed as the Honorary Professor in Geology by the University of Delhi.

At the Wadia Institute of Himalayan Geology

Along with the creation and development of the new teaching and research Department of Geology in the University of Delhi, Professor Jhingran also fostered another new institution devoted to research in Himalayan Geology—the Wadia Institute of Himalayan Geology—initiated by the late Dr D. N. Wadia with support from the Ministry of Education, Government of India. Professor Jhingran and a few others established the Institute. Utilising some rooms lent by the University of Delhi, the Institute started functioning in August 1968. Dr Wadia, however, died soon after and Professor Jhingran filled in the gap by acceding to the persuasion of the Government to work as its Honorary Director, in addition to being Head of the Department of Geology of the University of Delhi. Later, with the approval of the Government, he renamed the Institute as Wadia Institute of Himalayan Geology, after the late Dr D. N. Wadia. About a year later, i.e., after the death of Dr M. S. Krishnan who was the President of the Institute, Professor Jhingran became the President of the Institute.

The Institute organised seminars and symposia devoted to work on Himalayan Geology by Indian and foreign scientists. Gifted as Professor Jhingran was in organizational functioning, he raised the level of these seminars to international standards. The deliberations attracted Himalayan geologists in India and abroad. Despite initial difficulties, he was able to establish a tradition that has helped foster the cause of Himalayan Geology. He personally edited the proceedings of the first seven seminars and published them as the *Himalayan Geology,* volumes 1 to 7. He, however, was not able to see the press copy of the volume 7, which the Institute dedicated to his memory after his demise.

On the advice of Professor Jhingran, the Government appointed a full time Director of the Institute in early 1976, and he relinquished charge as Honorary Director, but continued to be the President of the society until July, 1977. The Wadia Institute of Himalayan Geology and the Department of Geology, University of Delhi, thus remain monuments to the cause of teaching and research in Geology in the country.

Geological Literature in Hindi

Professor Jhingran had an intense love for Hindi, his mother tongue. He worked unsparingly for the development of Geological literature in Hindi. As member, and later as convener of the Committee for Geology and Geography under the Scientific and Technical Terminology Commission, he did much sustained work and helped in evolving a scientific terminology in Hindi, which has been accepted by many scientists. He also started a Hindi section in *Indian Minerals,* a publication of the Geological Survey of India, and was its Editor for several years. He translated

a well-known English text book on Geology to Hindi, which was later published by Madhya Pradesh Hindi Grantha Academy.

In 1968, he initiated and helped to develop an all-India body, the *Bhuvigyan Parishad,* with the objective of generating geological literature in Hindi. The Parishad published a quarterly journal devoted to Geology and allied sciences. The progress in this direction was entirely due to Professor Jhingran's untiring personal efforts. In early 1977, he was honoured by Delhi Hindi Sahitya Sammelan for his interest in the development of scientific Literature in Hindi.

Family

In 1931, Anant Gopal married Sharda Devi, daughter of a leading Ayurvedic practitioner of Delhi at that time. They had a happy family life and were blessed with two daughters and four sons. The eldest daughter, Indira, is married to Shri L. R. Sharma, who is now working as Vice-President (operations) in Indag Rubber Ltd. Bhiwadi, Rajasthan, since deceased Parwanu (H. P.). The second daughter, Aruna (the fifth child), is married to Shri J. S. Jaitly, an engineer in U.P. Instruments Ltd. Lucknow. His first son, Anand (the second child), is a textile engineer and is presently working in Aditya Mills in Kishangarh. The second son, Anadi, is a mechanical engineer and is working in Bharat Refractories Plant at Ramgarh in Bihar. The third son, Vinaya (the junior author) followed the footsteps of his father and took up Geology as his career. He is today on the faculty of the University of Delhi. His fourth son, Achyut, the youngest child, did a course in Automobile Engineering and is now running his own business. Professor Jhingran had a closely knit family. He was a benevolent father and was greatly loved and respected by his children and grand children. The father and children used to discuss many a matter like friends. Whether they agreed or differed, he had forged a unique sense of understanding in the entire family. Professor Jhingran possessed a forward, dynamic and optimistic outlook. He encouraged his children, his younger brother, and dependent widowed sisters to attain professional, intellectual and academic heights according to their respective aptitudes and abilities. He gave them a free hand in the choice of their careers. This was responsible for the wide variety of avocations that his family members chose for themselves.

Scientific Work

Professor Jhingran had the rare gift of blending and synthesising into a composite work in the professional career experiences of teaching, research and field work. He dominated the scene of Indian Geology for almost five decades, a distinction available to few.

His collaboration with the late Professor K. K. Mathur in the discovery of a new variety of amphibole—Girnarite, from Mount Girnar in Kathiawar is well known.

As a research student in the United Kingdom, he made a very intensive study of the Cheviot Granite, North Cumberland, which were penetrating and thorough,

and whose results were new and revealing. When he was awarded the Ph.D. degree, his Professor commended his achievements and observed *"although this area had recently been mapped by the Geological Survey, Dr Jhingran was able to add very materially to our previous knowledge."*

In the Geological Survey of India, Dr Jhingran carried out systematic mapping of extensive areas in parts of Orissa and Madhya Pradesh, and investigated several metallic and non-metallic deposits in the country as also in Bhutan and Nepal. He directed teams of the Geological Survey of India to locate additional resources of flux-grade limestone for the steel industry. He also participated in an expedition to the Spiti Valley with three Danish Geologists from June to August, 1950.

His work on Bundelkhand granite-gneiss is an example of thoroughness and attention to detail. While on this problem, he located the now famous pipe-rock, which later proved to bear diamonds.

In 1959, Professor Jhingran was assigned to organize the Base Metal Unit in the Geological Survey of India, and to identify and develop new resources of copper, lead and zinc, in which the country was deficient. The pains he took in this connection bore fruitful results in the location of large resources of copper ore in Roam-Siddheswar block in the Singhbhum Copper Belt in Bihar, the Agnigundala block in Andhra Pradesh; Mamandur field in Tamil Nadu and Kalyadi in Mysore; of zinc ore in Rajpur-Dariba Block in Rajasthan. He also successfully guided the exploration for phosphorite in Rajasthan and Uttar Pradesh and for pyrite, in Rajasthan and in Bihar.

Professor Jhingran headed, in his time, the project of the preparation of modern geological maps entrusted to the Geological Survey of India by the Economic Commission for Asia and Far East, as part of its policy for assisting the development of the constituent countries including Japan, China, Phillipines, Indonesia, Ceylon Burma, Pakistan etc. The other maps brought out under this series related to mineral distribution, and the project was handled in joint collaboration with Japan. Professor Jhingran also guided the revision of the 1932 edition of the Geological Map of India. He also supervised several students for their doctoral theses on various aspects of Himalayan Geology.

Distinctions

Distinctions came to Professor Jhingran throughout his life. The University of Delhi, Geology Department, celebrated his sixtieth birthday in 1968 and sixtyfifth birthday in 1973 with great enthusiasm. On these occasions, tributes were paid to him for his achievements in Geology. Sir Kingsley Dunham (Director, Institute of Geological Sciences, London) wrote : *"Your services to Geology, both as a member and eventually as Director-General of the Geological Survey, and in academic life have been considerable. I am sure that you will be remembered particularly for your work in the Himalayas."* Professor W. C. Krumbein and Professor Michael F. Dacey (Northwestern University, Evanston, USA) said *"..thus in your long and fruitful career you have accomplished the work of two lifetimes. We have no doubt*

that your present retirement from the University will be merely the beginning of a third equally successful career." Dr B. Shamakin (Institute of Geology, Moscow) wrote : *"My contacts and conversations with you in the time of my being in India, your kind letters to me after—will be the brightest parts of my Indian impressions."* Professor E. K. Walton (University of St. Andrews, Scotland) said : *"I wish to pay tributes to him as an outstanding geologist who has made significant contributions in many areas and topics in Geology....I would like to greet him as a fellow graduate of the University of Durham and share with him kind memories of Professor S. I. Tomkeieff who guided each of us in our early research work."*

His name appeared in *"Famous India—Nation's Who's who* (1975)", *"Reference Asia"* Volume I (1975), and also in the volume IV of the *"Men of Achievement"* (1977) of the International Biographical Centre, Cambridge.

He led and participated in Indian delegations to many international meetings : Soviet-India Symposium, Tbilisi, USSR (1975); International Geological Congress, Australia (1976); Economic Commission for Asia and Far East in Japan (1956).

He was elected President of the Geology and Geography Section of the Indian Science Congress (1958). He was also invited to deliver special lectures by various scientific organisations, viz., Birbal Sahni Institute of Palaeobotany for the *Seward Memorial Lecture* (1967), Oil and Natural Gas Commission for *A. M. N. Ghosh Memorial Lecture* (1974). He was active in the fields of education and science in the country and guided the activities of many scientific bodies and Universities in various capacities.

Association with Learned Bodies and Academies

Professor Jhingran's work brought for him many distinctions, earning for him recognition in various ways. Some of these are mentioned below :—

1. Elected Fellow of the National Academy of Sciences of India, Allahabad, 1952.
2. Elected Fellow of the National Institute of Sciences of India (Now Indian National Science Academy), 1954; Member of the Council 1966–68, Foreign Secretary, 1968–72.
3. President, Geology and Geography Section, Indian Science Congress, 1958.
4. President, Biological Science Section of the National Academy of Sciences, 1962.
5. President, Mining, Geological and Metallurgical Institute of India, 1964.
6. President, Association of Indian Geohydrologists, 1966.
7. Editor, *Transactions of Mining, Geological and Metallurgical Institute of India,* for several years.
8. Editor, Hindi Section of *Indian Minerals,* GSI, for several years.
9. Convener, Vigyan Vikas Samiti, New Delhi.
10. Organising Secretary, International Geographical Congress, New Delhi, 1967.
11. Chairman, Geology Committee of India for International Union of Geological Sciences, 1970–75.

12. President, Indian Geologists Association, 1970–72.
13. President, Geochemical Society of India, 1971–72.
14. President, Bhuvigyan Parishad, 1968-till death.
15. President, Indian Geological Congress, 1975–77.
16. President, Indian Association of Sedimentologists, 1976–77.
17. President, Wadia Institute of Himalayan Geology, 1970–77.
18. Editor, *Himalayan Geology*, 1971–77.
19. Member, Steering Committee, International Seminar on Himalayan Geology, 1976.

Last Days

On October 4, 1977, Professor Anant Gopal Jhingran handed over a manuscript to his stenographer, checked the diagrams with the draughtsman, and slowly rose from his chair. This was the text of his lecture he would deliver 10 days later under the auspices of the Indian National Science Academy. The academy would present him its coveted award—the first *D. N. Wadia Medal* (1977) for his contributions to Earth Sciences. He stepped out of his Delhi University Office in pain. He had a sore ankle which would be operated the next day.

After the operation, his doctor put the leg in plaster and advised him complete bed rest. The immobility prevented him physically from delivering his lecture on schedule at the Indian National Science Academy. It was a serious psychological setback to him. While confined to the bed, he suffered a stroke of myocardial infarction and had to be moved to the G. B. Pant Hospital, New Delhi. The end came on December 11, 1977, at about 1215 hrs following cardiac arrest.

V. K. Verma
Vinaya Jhingran

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SATYA CHARAN CHATTERJEE

(1905–1978)

Elected F.N.I. 1948

SATYA CHARAN CHATTERJEE, a pioneer petrologist of India, was born in a middle class Bengali family of Hoogly district on September 6, 1905 at Pabna (now in Bangladesh) where his father was a doctor. His father Dr Baidyanath was a man of rare qualities. He served in the Alipore Central Jail as an Assistant Doctor when Sri Aurobindo, the founder of the Pondicherry Ashram, was imprisoned there. Sri Aurobindo wrote about him. "*I had never seen such a sympathetic soul before, nor do I expect to see it after, it was as if he had been to help and do good to others. The best way to remove any want, injustice or needless suffering was to reach a report of it to the doctor's ears.*" It may be recalled that the killing of the approver in the famous Alipore Bomb-case took place inside the jail hospital. The authorities suspected Baidyanath of excess sympathy to the *Bande Mataram* convicts and wrongfully dismissed him. He died at the early age of 36.

EARLY LIFE AND EDUCATION

Chatterjee was hardly six years old when his father died. He was the only son of his parents. Mother Jaminibala was a courageous lady who struggled against poverty and want and with the little financial help received from relatives was able to educate young Chatterjee at South Suburban School of Calcutta where he passed his Matriculation examination in 1922 in the first division. He secured a first division in the I.Sc. examination held in 1924 and in 1926 graduated from the Presidency College, with honours in Geology, standing first in the merit list. He was awarded the Jubilee Scholarship of the University and again stood first in 1st Class in his M.Sc. examination in 1928. While serving as a lecturer in Geography in Bihar, Chatterjee kept alive his research activities in Petrology. Working mainly during the Summer holidays he could finalise his doctoral thesis to become the first D.Sc. of Calcutta University in Geology (1936). His examiners included Dr N. L. Bowen, Dr Robert Balk and Sir Thomas Holland. (N. L. Bowen instructed the University to pass on the remuneration due to him to Chatterjee as a token of encouragement for his outstanding research). In 1938, he was awarded the P.R.S. of the Calcutta University on his thesis on the Gabbro rocks of Mayurbhanj. Subsequently, he was awarded the coveted *Mouat Medal* for research.

S. C. Kathju

Contribution to Science

Professor Chatterjee was an eminent geologist. While he specialized in petrology, his research covered a wide range of subjects including mineralogy, economic geology and geomorphology. His most outstanding contribution included the studies of the anorthosites of Bengal. Curiously, his first research paper published in 1929 and his last one published in 1976 both deal with anorthosites. Besides Bankura anorthosites and associated rocks, he also studied the rocks from Mayurbhanj, and more recently, from Turkel in Kalahandi district of Orissa. Different types of anorthosites, their structural features, their origin and emplacement, were studied by him carefully and critically. He brought evidences in favour of a magmatic origin of these rocks, the original magma being anorthositic gabbro in composition. The subsequent metamorphsism under granulite facies and then to amphibolite facies and finally to the development of cataclastic and hydrothermal metamorphism, were clearly revealed by him. Clouding of feldspars and the development of four-ply corona structure in Olivine—norties involving olivine-pyroxene-secondary feldspar-garnet are some of the features worth recording. His subsequent important contribution was on the gabbroic rocks of Mayurbhanj (Gurumahisani Pahar and the origin of the associated magnetic deposits). He described several types of rocks not previously recorded. Identification of the orthopyroxene of the Bushveld type, recognition of the magnetic origin of the magnetic deposits, cataclastic origin of the micropegmatite in the granophyre etc. were some of the observations made by him.

In the valley of the river Mar near the village Messanjor (Canada Dam), there are exposures of charnockites with granulitic-noritic dykes where Chatterjee studied the stages of charnockitization on the basis of observations like absence of igneous texture, heterogeneous composition and secondary myrmekite structure in granulite zones a metamorphic reconstitution of the diopsidegneises were his conclusions.

Almost parallel with the study of the charnockites of Santhal Parganas, Professor Chatterjee studied the peridotites of Manpur, Singhbhum district, Bihar, and the origin of the asbestos originated by the alteration of a body of ultrabasic rock intrusive into the Archaean crystallines was described. He proved the transformation of non-fibrous serpentine into fibrous asbestos by stress acting along certain zones. Transformation of chrysolite into tremolite might have been: .5 Ca Mg $Si_2O_6 + H_2O + 3\ CO_2 = Ca_2Mg_2Si_8O_{22}(OH)_2 + 3CaCO_3 + 2SiO_2$

Since 1956, for more than a decade, Professor Chatterjee associated himself with the study of various aspects of Deccan traps. It was Professor Chatterjee (1964) who for the first time suggested the possibility of the occurrence of the alkali-olivine basalt sub-province in the Deccan Traps. Earlier he described a series of lavas from Pavagadh Hill near Baroda in Gujarat (1961, 1963) comprising picrite basalt, alkali olivine basalts, hawaiite, mugearite etc. His reporting of mugearite met with severe criticism from scientists who believed that tholeiitic basalt was the only possible parental magma for the entire Deccan Trap region. More recent work by others on Deccan Traps has confirmed his identification of mugearite and the presence of alkali-basalt type of rocks whatever may be their

origin. Another interesting paper of Professor Chatterjee concerning Deccan Traps was on the study of the inclusions in the Girnar complex. Here he brought evidences against the conventional concept of the origin of the lamprophyre (1971). His suggestion that Mount Girnar was pre-Deccan trap needs careful consideration from the point of view of structure and geochemistry of these interesting suite of rocks. Later in his career, he again became interested in the study of the anorthosites and from his latest studies of them in West Bengal, he proved two different phases in their emplacement. He concluded that the development of minerals of amphibolite facies in some of these rocks was not due to retrogression of the rocks previously raised to the granulite facies, but reflected the change in PH_2O and T conditions during their recrystallization (1976).

Several students carried out research work under the guidance of Professor Chatterjee a number of them obtained their degrees. Remarkably, he never published any paper jointly with his students.

Professor Chatterjee was the author of 33 research papers. In addition he wrote many scientific articles of geographical and geological interest.

He was the author of the well-known *"Petrology of the Igneous and Metamorphic Rocks of India"* which is a useful reference guide to post-graduate students and research scholars.

Professional Career

Chatterjee began his professional career as a research student under the late Professor Hemachandra Das Gupta in the Presidency College, Calcutta. However, he had to temporarily abandon research to accept the position of Lecturer in Geography in the Bihar Educational Service, where he served until 1949. During this period he was gradually promoted to the rank of the Assistant Professor and subsequently to that of Professor. In 1949, the Government of Bihar offered him professorship in the newly started Department of Geology at the Patna Science College. The Universty of Patna changed to a teaching and residential university in the year 1952. The same year he was appointed the J. N. Tata Professor of Geology. He continued there till 1961 when on the advice of Professor W. D. West, he went to Vikram University at Ujjain in Madhya Pradesh. Here he built up the School of Studies in Geology. Even after his official retirement from service he continued his teaching and research activities as U.G.C. Research Scientist for another three years. In 1973, the Vikram University offered him the post of Professor Emeritus. On the December 20, 1977 he fell seriously ill and was confined to bed till his death on June 1, 1978.

Distinction and Honours

Professor Chatterjee was a Fellow of almost all the major scientific and geological societies of India. He was a Fellow of the Society of Economic Geology of U.S.A. from 1945 to 1970. He was elected a Fellow of the Geological Society of London

in 1961. While serving as a teacher of Geography, Professor Chatterjee was elected a Fellow of the Royal Geographical Society. In the year 1948, he was elected a Fellow of the National Institute of Sciences of India (now the Indian National Science Academy). He presided over the Geology and Geography Section of the Indian Science Congress in the year 1939. He was elected alternate Chairman of the Charnockite Section of the 22nd International Geological Congress held at New Delhi in 1964. In 1968, he was elected member of the Sub-commission on Petrology under the International Union of the Geological Sciences. This honour came to India for the first time. He was the Chairman of the Section of Petrology & Minerology for the International Symposium on the Deccan Trap and other flood eruptions held at Sagar in 1970. He was member of the Grant-in-Aid Committee of the Council of Scientific and Industrial Research for nearly a decade.

Family Life

Professor Chatterjee was married to Umarani Devi in 1932. Mrs Chatterjee comes from a well-reputed family of West Bengal, which has produced many talented people in the judiciary, administrative and foreign services. She is the only sister of Dr P. N. Bannerjee, former Vice-Chancellor of Calcutta University and Justice A. N. Bannerjee of Calcutta High Court. She was a source of inspiration for her husband, and together they led a simple and pious life. They had a daughter and two sons. The elder son, Dr A. C. Chatterjee (the second author of this memoir) is now a Reader in Geology at Vikram University in Ujjain. The younger son Dr S. Chattopadhyaya, a Ph.D. from Canada is presently a Reader in the Institute of Medical Sciences at Banaras. His daughter, Roma has a master's degree in Economics and is presently an Assistant Librarian in the Government of West Bengal.

Social Virtues, Ideals and Outlook

Professor Chatterjee was a man of character who never compromised with any injustice. His sense of punctuality, regularity and discipline left a permanent impact in the minds of people with whom he came in contact. Yet he was humane and it was a regular habit with him to provide financial assistance to needy students and others in distress.

He was an effective and eloquent speaker. His lectures, both inside the class-room and in scientific meetings were always highly appreciated for their lucidity and clarity.

Professor Chatterjee had an exceptional organizing ability. He built almost from scratch two University Departments of Geology, at Patna and at Ujjain. Realizing the need for training in Applied Geology, he reorganized the courses of studies of Vikram University and introduced subjects like hydrogeology and mining. He organized symposia on "Mineral Resources of Madhya Pradesh" and on "Strategic Minerals of India" under the auspices of the University Grants

Commission and Indian National Science Academy. He also started the *Journal of the Institute of Geology* to which many top ranking geologists in the country contributed papers. Unfortunately, after Professor Chatterjee's demise the publication of the journal came to a virtual halt.

In his passing away, India lost an able organizer of geological education. His contributions to petrology will be remembered as outstanding in the field.

V. K. VERMA
A. C. CHATTERJEE

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SOURINDRA MOHAN SIRCAR

(1908–1978)

Elected F.N.I. 1954

Birth and Parentage

Born in March 1908 in his native village, Paikpara, Kushtia district (now in Bangladesh), Sourindra Mohan was the youngest son of the late Gour Krishna Sircar, who had a long service in the Forest Department of the old province of Bengal (including Bihar and Orissa). Sourindra Mohan lost his mother when he was two years old and was brought up by his aunt.

Early Education

Sourindra Mohan was put in the village primary school under the direct care of his father, when the latter permanently settled in his native village after retirement. He studied at the C. M. S. School, Krishnanagar during 1914–18 under the care of his maternal uncle. During 1918–24, he read at the H. E. School, Kajupagla in Dacca district and Alamdanga High School close to their native village, where his eldest brother Shri Karuna Krishna Sircar was the Head Master. As a student in the High School, he used to stand first in almost all his class examinations and finally passed the Matriculation Examination of the Calcutta University in the First Division in 1924.

He then joined the Jagannath Intermediate College, Dacca (now in Bangladesh) and passed the I.Sc. examination of the Dacca Higher Secondary Board in 1926 with special credit in Botany. He lost his father soon after.

Education at Calcutta

Having imbibed an interest in Botany from his father and under adverse circumstances, Sircar joined the Presidency College, Calcutta from where he took his B.Sc. degree with Honours in Botany in 1928. For reasons of health he had to discontinue his studies for a year and stayed with his lawyer brother at Kurseong, Dist. Darjeeling.

In July 1929, Sircar joined the post-graduate classes in Botany of the Calcutta University and took his M.Sc. degree in 1931, having specialised in Plant Physiology and Anatomy. Here he came in contact with the late Professor S. P. Agharkar, the

S. M. Sircar

then Ghosh Professor, and one who was largely instrumental in shaping his future career.

Early Researches

Opportunities for research in those days were very few. After working for sometime with late Professor S. R. Bose at the R. G. Kar Medical College, Calcutta and late Professor P. Parija at the Ravenshaw College, Cuttack (Orissa), in an honorary capacity, it was through the influence of the authorities of the Ramakrishna Mission at Belur Math, that he came in contact with the late Dr Bosiswar Sen, who had by then created the nucleus of Vivekananda Laboratory at Bosepara Lane (now Srima Saradamoni Sarani), Calcutta (The Laboratory was later shifted to Almora, U P.), with meagre facilities available there, Sircar worked for a couple of years on mitochondria in the root hairs of *Azolla,* when such work involving, plant Biochemistry was still in its infancy in India.

At London

In July 1934, Sircar joined the Imperial College of Science and Technology, London and worked under the guidance of Professor F. G. Gregory, F. R. S. He also had training in mineral nutrition at Rothamsted Experimental Station, Harpenden, England. His work on protein synthesis in potato tubers is probably one of his pioneer significant contributions to our knowledge on protein synthesis of plants and for which he earned the Ph.D. degree of London University and Diploma of the Imperial College.

At the Calcutta University—As a Teacher and Research Guide

In July 1937, Sircar was appointed Assistant Lecturer in the Department of Botany, Calcutta University. He successively served as a Lecturer and Reader and in 1960, succeeded the late Dr I. Banerji as Head of the Department. He was soon after appointed to the Chair of Sir Rash Behari Ghosh Professor of Botany, a post that remained unfilled, with the death of its previous incumbent, Professor P. C. Sarbadhikari, since 1953.

Sircar initiated and organised the Plant Physiology Laboratory of the University for teaching and research that became an active centre of research in India.

While teaching in a University of Calcutta, he twice went on deputation as Head of the Department of Biology, Dacca University (Now in Bangladesh—1946–47) and as Professor of Agricultural Botany at the Central College of Agriculture, New Delhi (1949–51).

In the early forties he worked extensively on vernalisation and photoperiodism. These studies indicated that induction of early flowering of rice by the appliation of short day treatment to seedlings for varying periods would be achieved, and that

the photoperiodic effect of short days is of a quantitative nature as the degree of earliness for flowering increases with the duration of treatment.

The phenomenon that the photoperiod–sensitive *aman* rice varieties flower at a fixed day length occurring twice in a year was observed by Sircar and his associates in the late forties. As a result, a sizeable acreage of *boro* crop in West Bengal is now planted after photoperiod sensitive *aman* rice is harvested. The State Department of Agriculture, persuaded the farmers to adopt this practice for double cropping. From August to next April two crops of *aman* rice could be cultivated with proper irrigation facilities. A remarkable influence of short days on the reduction of flowering duration from 133 to 47 days was recorded in the winter variety *Rupsail* (with Parija, 1945; and with Ghosh, 1947). The flowering of rice within such a short period was not reported earlier for any Indian variety. The change of shoot apex to flowering apex after photoperiodic treatment was studied by Sircar with Sen in 1950 and later in 1953. The metabolism of nitrogenous substances in relation to flowering of rice (*Rupsail*) the control of growth of rice plant by different qualities of light and of reproduction in cultivated and wild rice were also studied by Sarkar and coworkers in 1948, 1970 and 1975 respectively.

Studies on the nutrition of the rice plant by Sircar from 1941 to 1966 formed the basis of the fertilizer requirements of the 'indica' varieties. In the early forties, he and his associates noted that in the absence of adequate levels of phosphorus, rice plants fail to metabolize inorganic nitrogen to protein resulting in an accumulation of soluble nitrogen and reduced growth (with Sen, 1941; and with De, 1948). The effects of fertilizer stress under different combinations of nitrogen and potassium with a constant level of phosphorus on the physiology of lodging of rice were studied by him, with Bhattacharya in 1964 and with Mukerji and Kundu in 1968. It was found that when nitrogen is applied in conjunction with potassium it improved the mechanical rigidity of the stem. It clearly demonstrated that the proper levels of nitrogen, phosphorus and potassium supply are needed for raising the yield of rice plant. His findings concerning the physiology of lodging of rice during rainy season have been of considerable help to farmers in recent years.

In the early fifties, he started research in the field of plant hormones. From the studies on the endogenous levels of indole acetic acid in different organs and phenolics and absciessic acid in seeds and their relation to germination, growth, reproduction and metabolic processes of rice plant (with Das, 1955; with Das & Lahiri, 1955; with Chakraborty, 1957; with Bose, 1960; and with Dey, 1968), it was felt pertinent to undertake investigations on the naturally occurring hormones in the tropical plants. One of the interesting plant materials studied was water hyacinth (with Kundu 1960; with Ray, 1961; with Chakravorty, 1961; and with Sircar & Banerjee, 1973). Several tropical plants like *Borassus flabellifer, Cassia fistula, Fraxinus* sp., were examined for their profiles of growth regulating compounds (with Mukherjee *et al.*, 1965; and with Sircar *et al.*, 1970). This group isolated tetrahydrogibberillic acid from *Sonneratia apetala* (with Ganguly *et al.*, 1970; and with Gaskin *et al.*, 1972), indole inhibitor Rhizophorine (with Saha *et al.* 1978) and an indole rhamnoside from *Peltaphorum ferrungineum*

(with Ganguly *et al.*, 1974). He further, carried out investigations on the physiology of rice seed germination. The failure of germination of rice seeds is related to the formation of inhibitors during storage or after exposure of seed to light of increasing wave length (with Biswas, 1960). In non-viable rice seeds supraoptimal concentration of IAA and inhibitors like coumarin, sinapic, ferulic and abscissic acids were detected by him (with De, 1967, 1968, 1968*a*). His group studied the variations in respiration and carbohydrate, nitrogen, nucleic acid metabolism and hydrolyzing enzymes during germination and at different times of maturity of seedlings (with Paul & Mukherji, 1971). Conversion of nicotinamide and nicotinic acid to NAD has been noted in germinating seeds and of the nicotinamide coenzymes, a combined pattern of NAD dominance at the early stage and then NADP at the later stages of germination was observed (with Mukherji & De, 1968). He studied the profile of inhibitors of *Shorea robusta* seed, a timber yielding plant, which becomes non-viable after two weeks from fruiting (with Ganguly & Saha, 1976).

For the past several years he had been working on a book concerning physiology of rice plants embodying his life's contribution towards this aspect of plant physiology that remains unfinished. He was the author of a book entitled *Plant Hormone Research in India* published by the ICAR in 1971.

As Director—Bose Institute

In 1967, Professor Sircar was invited to succeed the late Dr D. M. Bose as Director of the Bose Institute, Calcutta. It was due to his untiring efforts that the Regional Sophisticated Instrumentation Centre of the Department of Science & Technology was established at the Bose Institute to cater to the needs of scientific workers in the eastern region—the Institute having attained a high level of excellence in instrumentation due to the pioneering efforts of its founder—Director Acharya Jagadish Chandra Bose.

It was also due to his efforts that a full-fledged Department of Biochemistry was added to the existing departments and that the Plant Physiology Section of the Department of Botany was re-organised that enabled him to continue the researches initiated by him in the Calcutta University.

He became interested in the study of photosynthetic efficiency of the rice plant. It was established that the photosynthetic efficiency of rice is secondary in importance to the translocation of photosynthate from leaf and stem to the ripening grains, in so far as grain yield is concerned. Adopting radioactivity assay technique, it was clearly demonstrated that the local tall varieties are not photosynthetically less efficient, rather some of them are more efficient than the short 'japonica' varieties but deficiency in transport to the grains is the cause of the relatively low yield. The accumulation of photosynthates in the source leaf followed by the reduction in photosynthetic rate was noticed as a result of the removal of the sink panicle (with Das, 1974; and with Palit *et al.*, 1976, 1978). The results also indicated a rapid inactivation of RuDP carboxylase activity in the source leaves in absence of sink. Professor Sircar's group tried to ascribe some role for the enzyme phosphoenol

pyruvate (PEP) carboxylase in the C_3 rice plant. An increase in the PEP carboxylase activity in rice grain during grain filling period was shown to supply TCA cycle intermediates for high synthetic activity during the period (Kundu *et al.*, 1978; and Self, 1978) rather than retrapping CO_2 for economy.

As Emeritus Scientist

After his retirement from the Bose Institute in 1976 he rejoined his *alma mater* as Emeritus Scientist of the I. C. A. R., and he was actively engaged in research in plant hormones, development of new bioassay methods, immunoassay etc. He and his group were actively trying to throw light on the target activity of hormones.

International Connections

Professor Sircar travelled widely in Europe, Japan and U.S.A. with a Rockefeller travel grant and Sir Rash Behari Ghosh Travelling Fellowship of Calcutta University in 1958–59. In 1963, he visited various botanical centres in USSR as a member of the Government of India delegation. FAO of the United Nations invited him to deliver lectures at the International Centre of rice breeders at Australia, New Zealand and Phillippines in 1973. He represented the Indian Science Congress Association at the Annual Meeting of the British Association for the Advancement of Science in England in 1969 and the bicentennial meeting of the American Association for the Advancement of Science in Boston in 1976.

He conducted an International Symposium on 'Plant Growth Substances' held in January 1967 in the Department of Botany, Calcutta University and edited its proceedings.

Professor Sircar was elected an Honorary Fellow of the German Academy of Natural Sciences in 1974 and a Vice-President of the International Botanical Congress held at Leningrad in 1975.

Awards and Honours

Professor Sircar was elected a Fellow of the Indian National Science Academy in 1954 and of the Asiatic Society, Calcutta in 1969. The Society awarded him the Paul Johannes Brühl Memorial Medal in 1966.

Professor Sircar was elected President of the Indian Botanical Society in 1969 and the Society awarded him the *Birbal Sahni Medal* in 1970.

Professor Sircar was General Secretary (1972–75), Treasurer (1968–71), President, Botany Section (1963) and General President (1977–78) of the Indian Science Congress Association. As General President, he delivered an address on *Science Education and Rural Development* embodying his thoughts concerning a vital problem affecting our nation. He also delivered the First Agharkar Memorial Lecture at the Maharashtra Association for the Cultivation of Science, Pune. He was awarded the *Rafi Ahmed Kidwai Prize* and Medal of the I. C. A. R. for the biennia

1968–71, for his outstanding contributions to the physiology of rice plants. In addition, he was President, Botanical Society of Bengal, Indian Society of Plant Physiology, Indian Photobiological Society, Plant Biochemical Society etc. at different periods.

His Sudden End

Professor Sircar continued his research work till the last day of his conscious existence i.e., the day he was hospitalised for cerebral infection. He died on the morning of February 21, 1978.

Epilogue

Professor Sircar's interests were many and varied but he had few hobbies besides reading and writing. His refined and elegant taste manifested itself in his dress, gait, subtle humour and occasional flashes of a keen spirit of appreciation of things of beauty in art, literature and music. It was sheer delight to hear him, in rare moments of leisure. He was fond of toiling like the devil. He retained the spirit of profound veneration for his motherland.

He was a gifted teacher and inspired generations of students by his teaching and researches and created an active school of research workers some of whom are occupying important positions in various Universities and Research Institutes in India and abroad.

A soft spoken person with a kind and generous heart, he was always liked, admired and respected by his students, colleagues and subordinates. He showed remarkable tolerance in his approach to students and fellow people. Above all, he was a thorough gentleman and an able administrator. In his death, India has lost a great scientist, Botany its great champion and Plant Physiology, a critical investigator of rare merit.

He was married to Srimati Santi Devi in 1933 and is survived by his wife, four sons and two daughters—one of his sons Dr P. K. Sircar is a lecturer in the Department of Botany, University of Calcutta.

A. K. Ghosh
A. K. Sharma

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ANIL KUMAR GAYEN

(1919–1978)

Elected F.N.I. 1966

ANIL KUMAR GAYEN was born on February 1, 1919 in a family of peasants belonging to a small village in Midnapore district, West Bengal. He lost his father in childhood. As a result he had to face a lot of hardships in his youth. These hardships did not deter him from pursuing education. Not only did he brave these difficult days but he also established himself as an eminent educationist and a social worker through hard work, dedication, ability and talent.

EDUCATION

Professor Gayen had a brilliant academic career. He completed his college education from the Calcutta University, getting first class. He obtained B. A. Hons (in Mathematics) in 1939 and M.A. in Applied Mathematics in 1943. He topped the list of successful candidates in the Master of Arts examination. He joined the Cambridge University in 1947 as a senior research scholar in Mathematical Statistics where he received his Ph.D. degree in the subject in 1950.

PROFESSIONAL CAREER

From 1944 to 1947, and later on from 1950 to 1954, Professor Gayen was engaged in teaching and research in statistics under the guidance of Professor P. C. Mahalanobis, both at I.S.I. and the University of Calcutta. He joined the Faculty of Mathematics, Indian Institute of Technology, Kharagpur, as Assistant Professor in 1954. He was promoted to the post of Professor in Statistics in 1965. He was the Head of the Mathematics Department from 1966 to 1974. In 1971, he was appointed Professor in the senior scale, a post he held till his death. During his stay at I.I.T., Professor Gayen developed a strong group of research workers in theoretical and applied statistics. Under his expert guidance and supervision sixteen research scholars completed their doctoral work.

Professor Gayen worked as Director of Studies of a research project on educational measurements sponsored by the Ministry of Education and the National Council of Educational Research & Training. The results of this team research have appeared in the form of six volumes which won the appreciation of educationists like Dr K. L. Shrimali, Sir John Sargent, Dr Zakir Hussain, Dr Triguna Sen, Dr B. D. Nagchoudhury and Dr V. K. R. V. Rao. Professor Gayen was

A. K. Gayen

Chief Editor of *Indian Society for Quality Control Bulletin,* a journal devoted to the statistical quality control problems in industry and market research. A few monographs on quality control in industry, control charts on shop floor, acceptance sampling techniques, etc. were published by this Society under the authorship of Professor Gayen. Professor Gayen was the Founding Editor of publications of the Indian Society of Psychometry and Education. He served as an Editorial Secretary of the *Proceedings of ISTAM.* He was author of a popular and well-known book on *Advanced Calculus.*

Contributions to Applied Statistics

Professor Gayen made significant contributions in the field of applied statistics. This is reflected from the attached list of numerous publications in journals of international repute. His studies, connected with the effect of non-normality on standard normal theory tests of significance, are well known to workers in the field. To cite a few, Professor R. L. Plackett's book on *Regression Theory* devotes a number of sections to Professor Gayen's work on properties of permutation distributions and departures from standard test conditions. His results on non-normal sampling distributions are included in Dr O. L. Davis's book entitled *'Indusrtrial Experimentation."* Professor C. R. Rao's well-known book on *'Linear Statistical Inference and Applications'* mentions his research work dealing with the distribution of product-moment correlation coefficient. Results of these studies on the measurement of discriminating powers and reliability of tests are being widely used by research workers in psychometric and educational measurement problems.

Honours

Professor Gayen won various academic honours and distinctions. He was elected Fellow of both the Royal Statistical Society and the Cambridge Philosophical Society in 1950. He became Fellow of the Indian National Science Academy in 1966. He was member of various professional and academic societies like Indian Statistical Institute, ISTAM, Indian Society for Quality Control etc. He was President of the Statistics Section at the 58th session of the Indian Science Congress, Bangalore, in 1971.

Apart from these academic distinctions, Professor Gayen served as member of several expert committees appointed by the State and Central Governments to look into the problems connected with educational and examinatio-reforms, development of Indian Standards etc.

Social Worker

Professor Gayen was not only a well-known educationist but also an untiring social worker who devoted much of his time for the uplift and welfare of economically and socially backward people. Inspired by the ideals and teachings of the Ramakrishna Mission and of Shri Iswar Chandra Vidyasagar, he strove to provide

weaker sections of society adequate opportunities for education. To this end he founded the Regional Education Association, Midnapore to serve as a forum to educationists of the district to suggest ways of improving eduction. The association under his Presidentship recommended the setting up of a new type of university which would look after the educational aspirations of the backward sections of the people of the Midnapore district. Dr Gayen's almost single handed efforts bore fruit when the State Government and the Government of India accepted his proposals. The physical and mental strain involved in this herculean task proved too much even for a man of his sturdy health and stamina as a result, he passed away on February 7, 1978. It is perhaps no exaggeration to say that he sacrificed his life to make his mission a success.

B. R. SETH

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LAL CHAND VERMAN

1902–1979

Elected F.N.I. 1946

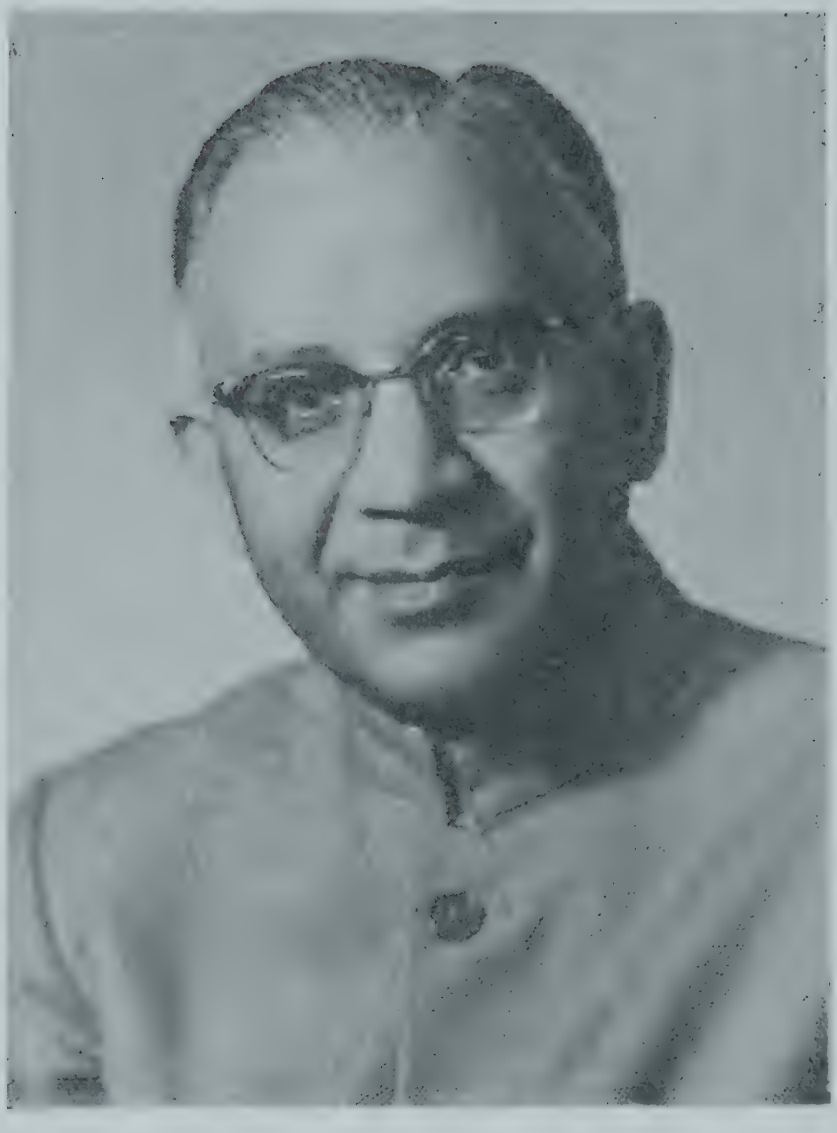
LAL CHAND VERMAN, the first Director-General of the Indian Standards Institution and the architect of standardization in India passed away on October 21, 1979, after a brief illness. He was 77.

Dr Verman, reckless in his adventures, unceasing in his activities, profound in his wisdom, exuberant in his emotions, impatient at delay and slovenliness, direct in his approach, severe in his attacks, yet simple as a child, was a rare personality in this world of ours. He lived a full and rich life, fully conscious of the revolution he had brought about single-handed in the domain of standardization in India, yet completely unspoilt by his success and by the honours showered on him at home and abroad. Indeed, such men are few.

EARLY LIFE

Lal Chand Verman was born on September 3, 1902, at Amritsar (Punjab) in a well-known Ahuja family. He later changed his name to Verman. His family was in business, not perhaps with a capital B in the modern sense of the term, involving large capital. At the turn of the century, Punjab was going through a wave of religious revival, and simple moral virtues were stressed in the life of the young. People tried to be good, and do good. Lal, like other children of his generation, was fed on copy-book maxims. The middle class had its strict code of morality, and this stood Lal well.

His education started early with a *Pandha*. We do not see this kind of teaching and discipline nowadays. In a Pandha's school, the pupils marched the streets in a snaky line, lustily reciting their multiplication tables—not only 17 times 19, but 11 times two and three-quarters or four and one-fourth times one-and-a-half. Lal did rather well. We may now scoff at this type of training, but in days when tradesmen dealt with a yard or 3 feet or 16 girahs, a foot with 12 inches and further refinement to quarters and eighth of inches on the one hand, and a rupee with 16 annas, an anna with four paisas and a paisa with two dhelas of three pies, the tortuous tables of *Pandha* served a useful purpose. Perhaps, it was at this time that the idea occurred to young Lal to rationalise the systems of weights, measures and money in India to simple but logical denominations, so that people, educated or illiterate, young or old, would have little difficulty in transacting business. In later life, he had to work hard to secure the adoption, at the policy level by the



Harry S. Truman

Government of India, of the metric and decimal systems. It was a long battle and until Nehru intervened to give him sustenance, support and strength, a losing one. For introducing the metric system in India against heavy odds, Lal deserves a niche in India's Hall of Fame.

Lal changed over to formal studies later than most others. This was in a way a blessing as he was of small stature and might have suffered at the hands of his more aggressive classmates. But his mature mind and the high level of performance in his studies, impressed both his teachers and his class fellows.

Then came a change in his life. He was within earshot of the ghastly Jalianwala massacre and he came under the influence of *Swami Satya Deva*; an Indian widely travelled and educated in U.S.A. His articles in *Saraswati,* a leading Hindi monthly of the time, inspired Lal deeply. He learnt that in America, merit and not birth measured the worth of a man. "Earn while you learn" was a novel notion. Lal made up his mind to got to the States and become an engineer. He had no money, but possessed the indomitable will to face difficulties or hardships. He left India when he was only a boy of fourteen.

Getting into European clothes for the first time, he set out along with two other youths *via* Calcutta, Hong Kong, Nagasaki to Vancouver, Seattle and San Francisco. At Seattle, they took time off for a stroll and were amazed to see a white man engaged in the lowly task of pushing a wheelbarrow. They stood by a fruit stall and the vendor asked them, "What can I do for you ?" What a difference ! A white man offering to serve them—to sell them fruit ! A new world was opening. On his arrival to report for his first job on an Indian's farm in California, he was accosted by a burly Punjabi Jatt turning the scale at 200lbs. He sized Lal up and down and then said contemptuously, "I asked for a man, and they have sent me a *cividen*t (student)." What was left unsaid in Punjabi, which for an angry man is a forceful and uninhibited language, was made up by the expression of disgust and contempt. "Now that I am here, why not try me?" asked Lal.

A man was sorely needed for hay gathering. Lal's offer was fair enough. He was engaged on $ 3 a day, and had to work for 10 hours daily. The farmer worked him hard but the "*cividen*t" made good. For one year, he went from job to job in California, which included tractor driving, ploughing, hoeing, weeding, irrigating, fruit picking, harvesting and what have you. But after a year in the University of California, Lal realized that he must earn his keep through engineering trades, rather then through odd jobs on farms. But here again, every small operation was a trade. Filing was a trade, lathe operation was a trade, riveting, drilling, moulding, and even dish washing were trades. He moved East to Michigan, where he found wages more adequate to enable him to accelerate his progress through college; from semi-skilled trades, he moved on to skilled ones like those of electrical repairman and draftsman and designer.

He also learnt that in U.S.A., more than elsewhere, bluff was synonymous with enterprise, as long as it succeeded. Once, he had to make an assembly drawing from three to four intricate auto body panel drawings. No matter how hard he

tried, they would not fit. He turned to a kindly man on the next table for a helpful hint and the reply almost knocked him down—"Do not ask me brother ! I know damn little about this. You are new, I am raw." Finally, he managed to engage the foreman at a discussion of the details which led to the solution he was seeking. He was not, however, always successful in negotiating his wages. Once he asked for $ 150 a month and got it without question, discovering later that the regular wages was $ 200.

In the college, he worked and got paid for it. Bright boys helped their professors by correcting class-work records at $ 1 an hour. Lal tried his hand at this, found it rewarding and learnt to pick out errors not easily noticeable. This initial training was a great help to him in later life.

Lal obtained the B.S. (Engineering with Honours) in 1927 from the Michigan University. He moved to Cornell University and his first research project was on ionosphere and fading of a radio wave reflected from it. He received his M.S. in 1928 and Ph.D. degree in 1930 on this subject. During his research career, he was elected to honorary societies of Tau Beta Psi for engineers and Sigma χi for research accomplishment. Summer earnings in Detroit supplemented his research fellowship income. After obtaining his doctorate degree, he received lucrative offers from both Universities and the Industry in U.S.A. But Lal had always harboured a strong sense of patriotism. He turned down many offers and returned to India in 1931. There is an interesting anecdote about Lal's patriotic feelings. Once in the U.S.A., alongwith two other friends, he beat up an Indian youth who was making anti-Indian propaganda and who could not be persuaded to give it up. This act of taking the law in his own hands, landed Lal and his friends in jail for one night.

Career in India

In India, there was no job for Lal. In the 1930's American degrees were looked down up on and any one who was "England returned" was given undisputable preference. In one interview, Lal was asked how much money he had paid for his Cornell Ph.D. ! Any other person with less devotion to his motherland would have returned to U.S.A. and perhaps stayed there permanently. Lal was ultimately granted a scholarship at the Indian Institute of Science, Bangalore, by the late Professor C. V. Raman, who was then its Director. And so, Lal started his research in the Department of Electrical Communication Engineering.

In 1931, London Shellac Research Bureau was created by the Indian Lac Cess Committee. Its President, Sir T. Vijayaragavacharya, who though familiar with the bureaucratic scale of values in India and the weightage that had to be given to the politically accommodative antecedent selected Lal on merits as a Research Physicist out of numerous applicants, many with British degrees. So, Lal went to London in 1933. He spent two years there and in 1936 was appointed Research Officer of the Industrial Intelligence and Research Bureau of the Indian Stores Department, Department of Commerce, Government of India. This office was located at Calcutta and was adjacent to the Government Test House. The late Dr Atma Ram,

retired Director-General, C.S.I.R. and former Chairman N.C.S.T. was one of his Research Associates.

Government sponsored research, bearing on industries was in those days a somewhat new experiment. The Test House had practically no responsibilities for research. It was concerned primarily with the testing of the industrial products sent to it by the Government and by corporate purchasing organizations, manufacturers and consumers. Verman, as the first Research Officer, was given the administratve and organizational responsibilities of the research wing of the Bureau. The officers of this Research Bureau were intiated into the work through testing of commodities, like oil, paint, varnish, metal and electrical goods etc. An introduction to industral research through testing and examining industrial raw-materials and commodities was a useful training for future research. Curiously however, some of the Ph.Ds recruited for the Bureau for their research qualifications were almost permanently kept on the testing side and research problems were assigned to those who had been engaged in testing. This mix-up of research with testing was not appreciated by the new entrants, and some even decried it.

As in all Government establishments the staff, technical and ministerial, was divided into two categories, the Gazetted i.e. *Sahebs,* and the non-gazetted which, on the technical side comprised mostly research assistants, the *Babus*—two distinct classes with a rigid barrier which kept them apart. To the people who had worked under some of the eminent scientists in the country and abroad, this appeared rather strange and was a matter of considerable misunderstanding and, at times, even of resentment. No particular person was to blame for this; the system was such that the interaction between the *Sahebs* and the *Babus* was not encouraged, if not actually discouraged.

The Industrial Research Bureau, as the original organisation became known, had an Advisory Council mainly meant to advise the Bureau on selection of problems. These problems were quite wide ranging : Glass, dry batteries, cement, clinker, anti-knock fuels, and so on, possibly about a dozen. Through his approach and a sense of inquiry, Verman was able to handle the problems with considerable ease.

With the creation of the Board of Scientific and Industrial Research in 1940, which became the Council of Scientific and Industrial Research in 1942, the Research Bureau merged with the Board. The stress of war and the dynamic personality of Dr Shanti Swarup Bhatnagar, then designated as Director, Scientific and Industrial Research, electrified the research atmosphere of the country.

In 1940, Verman became an Assistant Director of the Board of Scientific and Industrial Research. All engineering problems, particularly production of a wide range of plastic articles, a field in which Verman had already made significant contributions, were left under his care.

In 1944, he was made Acting Director of the newly created National Physical Laboratory at Delhi.

The Indian Standards Institution was set up around 1946. Lal always wanted to take up challenging tasks. He was aware of the chaos and confusion that

prevailed in the production of different varieties of consumer goods of all descriptions; he had witnessed the rigmarole of the British systems introduced in India in weights and measures, and the agony of our countrymen in obtaining quality products and in making calculations. Perhaps, his early childhood experience of reciting complicated mathematical tables came to his mind, and he decided to make standardization his career. He assumed Directorship of the ISI in 1946. Standardization became his life, his love, his abiding passion and, till the time he breathed his last, he was deeply immersed in his own creation which not only took roots under his loving care and nourishment, but spread throughout India. India will always be grateful to this short statured but determined man who introduced the decimal system to the country and the certification marks on her consumer goods. The ISI mark on goods became a hallmark of quality.

Verman and the ISI

Verman took over the stewardship of the Indian Standards Institution right from its inception in June 1947 and continued to guide it skilfully and resolutely till his retirement as Director-General on September 2, 1966.

From the very initial stage, Verman regarded Standardization as a unit whole, with a view to bringing into perspective all activities, directly or indirectly related to it, and placing particular emphasis on organisation, planning and direction, especially from the point of view of national development In India, just after independence, there were different standards for weights, measures and money transaction. There were fairly complicated and it was hardship for ordinary people to make calculations for commodities purchased by them. In the field of consumer goods, things were no better. There were many varieties of the same article in different dimensions and specifications and there was no standardization. Verman devoted all his energy to bring into force standardization in all spheres. It was indeed a formidable task, for neither society nor Government was ready for change in established systems. Verman applied himself with singular devotion and resolutely handled all obstacles that came in his way.

Metric System

In ten years of its existence, ISI was able to introduce the metric system in weights and measures in the country.

On the day the Interim Government of India took over, it passed its first Resolution No. 1-Std. (4)45 dated September 3, 1946, which brought into being the Indian Standards Institution (ISI) as the National Standards Body for India, with the following as one of its objectives :

"To consider and recommend to Government of India, national standards for measurement of length, weight, volume and energy."

Verman immediately undertook a detailed study of the problem and prepared a report on it. He suggested in the report, adoption of the metric system with Indian nomenclature for the basic units and an Indianised system of uniform nomenclature

for fractions and multiples. The report was submitted before August 15, 1947, when India became independent. The Report was published in the January 1949 issue of the *ISI Bulletin.*

Verman prepared another Report dealing with the design of decimalized coinage, and this was related to dimensions and weights of the metric system.

The two reports were considered by the Engineering Division Council (EDC) of ISI. The Council felt that the time was appropriate for recommending its adoption by the Government as a plan for standardization. A special committee with Dr J. C. Ghosh, an eminent scientist and the then Director-General, Supplies and Disposals, as Chairman, was set up in May 1948. The Committee included members from the Central Ministries, State Governments, C.S.I.R., P & T Department, Chambers of Commerce, All-India Manufacturer's Organization, Institution of Engineers (India) and the National Institute of Sciences of India (now the Indian National Science Academy).

The Committee met on October 22, 1952. There were divergent views amongst members of the Committee. Verman's paper was comprehensive and pointed out in an unambiguous manner, the benefits that would accrue to society and to industry by the adoption of the metric system in weights and measures. Several members referred to the difficulties to be overcome, and the considerable amount of work and expenditure involved. Others felt that as "*hands of the Ministries were already full with high priority problems, opportune time for the introduction of the metric system might be* 15 *or* 20 *years hence.*" The representatives of the Ministries of Agriculture and Natural Resources and Scientific Research (as they were known at that time) favoured early adoption of the metric system. The Ministry of Finance complicated the issue by declaring that decimalization of coinage should follow and not precede decimalization of weights and measures, and expressed the view that for various reasons, that was not the opportune time for reform. Serious attempts were thus made to shelve the proposal. Ironically its implementation brought relief to millions of our countrymen. However, a suggestion was made at the meeting for a rough estimate of the cost of the change-over in one or two illustrative cases, since it was felt that it might be helpful in reaching a decision "on principle."

The Ministry of Commerce and Industry requested all the other concerned Ministries of the Indian Government, to furnish estimates of the expenditure likely to be involved. It also asked the Planning Commission for its considered views on the general question. Circulars were issued to organizations of Trade, Commerce and Industry and others, eliciting their opinion regarding the changeover to the metric system.

Verman was however so keen on introducing the metric system that he spearheaded a move to raise the matter in the Planning Commission. At its meeting on August 30, 1954, the Commission decided that a comprehensive study be undertaken by Pitamber Pant, then Private Secretary to the Chairman, Planning Commission, in close association with the Indian Standards Institution. Verman had the opportunity to advance all his arguments in person to Shri Pant.

Certification Marks

Verman was specially interested in providing identification marks on consumer goods of quality. In our competitive world, various trade marks are introduced by industries making claims to excellence for the goods manufactured by them. Some of these are genuine, but many are exaggerated, or even false. The consumer is thus often confused and learns through experience, albeit a costly one.

In order to help the consumer, Verman introduced an ISI certification mark on various commodities. A product bearing this mark carries a third party guarantee (by the ISI) which implies that :

(*a*) The product meets an accepted standard, which is publicly available for inspection and study;

(*b*) Its production is carried out under continued supervision;

(*c*) It is appropriately inspected and tested with a view to determining its conformity to an authoritative and agreed standard; and

(*d*) If, for some reason, it does prove to be otherwise than claimed, the owner of the certification mark can be reached to redress the grievance and, not being a party either for sale or purchase of the article and anxious for his reputation as a third party guarantor, could be relied upon to do the right thing.

In order to fulfil these needs, it is essential to keep the certification marking operation absolutely impartial and beyond all reproach. The ISI took over this function and to ensure that the ISI mark on an article provides the necessary quality, Verman set up well-equipped laboratories for chemicals, textiles, electrical, structural and metallurgical articles.

Verman realised that for the certification marks to be fully effective, several controls were necessary. One such control was random checking of the production plant and testing of samples. Another control was regular inspection of the production process to ensure continued manufacture of quality goods. Highly qualified inspectors were recruited for the purpose. A third control was vigilance during distribution and marketing. This was important since many variations could occur during the handling of shipments and the invariable storage at various points subsequent to manufacture. A consumer must receive the certified product in as good a condition as intended by the requirements of the standard. All these were introduced.

In trade and commerce, much depends upon the integrity of the licensed manufacturer. Nevertheless, the possibility of unscrupulous elements always exists. In order to deal with them, Verman had the Indian Standards Institution (Certification Marks) Act passed which also incorporated legal sanctions to such recalcitrant traders.

The ISI certification mark, wherever it appears, may now be looked upon as a guarantee for quality—thanks to Verman's farsightedness and pioneering efforts in meticulously laying down all the needed safeguards.

Standardization

Verman fought relentless battles to bring standardization for commodities, industrial products and consumer goods. There were formidable difficulties, for to change a system established during the British Raj was no easy task. He was convinced that if independent India did not have standardization, industrially it would be weakened, commercially malpractices would flourish and economically India's growth rate would go down. Indeed, standardization has been defined by ISO (International Standards Organization) as :

"Standardization is the process of formulating and applying rules for an orderly approach to a specific activity for the benefit and with the cooperation of all concerned, and in particular for the promotion of optimum overall economy taking due account of functional conditions and safety requirements."

Today, ISI can justly boast of introducing an ordered system for industrial growth—thanks to the pioneering work by Verman.

Manak Bhawan and Manakalaya

With growing activities, a building for ISI was a must and Verman applied his mind to it in right earnest. Land was obtained in New Delhi, and Manak Bhavan, a magnificent six storied building came up and the ISI moved into it, in January 1958. Verman personally supervised the construction of the building and was there at the site every morning. The building bears eloquent testimony to his personality, infinite care and good taste.

Manak Bhavan soon became inadequate for the growing activities of ISI. In the late sixties, he built another equally beautiful building called Manakalaya, adjacent to Manak Bhavan. One could see the stamp of the Verman personality in this building also. The test laboratories and a few departments of ISI moved into Manakalaya in June 1966.

Training Scheme

Verman introduced, in 1958, a comprehensive training scheme to attract young scientists and engineers to make them "Standards Engineers." Intensive coaching and practical work were introduced as part of the curriculum. Verman felt that when so much depended on the performance of the technical staff of ISI, when people and industries relied on ISI certification marks and ISI standards, competent men were needed to tackle the problems that ISI faced. With meticulous care, he introduced a comprehensive training course for the engineers of ISI. The training scheme became a great success and many countries sent their engineers for training in this Institution. Soon, the training Institute became an international organisation for training in standardization and about two dozen experts from the third world countries regularly participated in it. With the experience gained in the training programmes, a course of instruction in standardization for use all over the world, is being drafted by the ISI.

Recognitions

Verman's pioneering efforts and leadership in the field of standardization were soon recognised at home and abroad.

He was elected the first Asian Vice-President of the International Standards Organisation (ISO) for two consecutive terms (1949–54).

1. In November 1958, Verman was awarded the first K. L. Moudgill Prize for "bold and imaginative planning, detailed and inspiring guidance, tactful yet resolute handling of the affairs of the ISI since its inception in 1947."

2. In November 1960, he was awarded the fellowship of the Standards Engineers Society, U.S.A.

3. In November 1964, he was awarded the Leo B. Moore Award (Medal) by the Standards Engineers Society, U.S.A. (the first award in 1963, went to Mr Robert S. McNamara, the then US Defence Secretary). This award was in recognition of Verman's "high achievements, extra-ordinary contributions in the field of standardization, and its advancement through creative application and service to his own nation and to the international community."

4. In 1966, he was awarded the Sir Walter Puckey Prize.

5. In 1967, the Government of India honoured him with *Padma Shri.*

6. He presided over the Indian Science Congress during 1969–70.

Verman was elected a Fellow of the Indian National Science Academy in 1946 and a Fellow of the Institution of Engineers. The Institution of Electronics and Telecommunication Engineers, honoured him by electing him a Felow in 1962.

Verman was associated with almost all the standards organisations throughout the world and served in many committees as Chairman, Vice-Chairman and Member. His erudition, deep knowledge, and forceful presentation of cases earned him deep respect from all.

In 1973, Verman did a signal service to standardization by founding the Lal C. Verman Research and Education Trust to promote the development of standardization as a new and distinct discipline. The Trust also presents the Lal C. Verman Award for outstanding contribution to the advancement of standardization in India. For the Trust, Dr Verman donated Rs. 25,000/– and another Rs. 25,000/– was added from royalties of his books.

Publications

Dr Verman was a prolific writer. He published more than a 100 original and technical papers in India, American and British scientific and technical journals. His book, "*Standardization—A New Discipline*" pubished in 1973, has been acclaimed as a classic in the field. As Senior Editor of the book, *"Metric Change in India"* published in 1970, he made it possible to record India's valuable experience of changing over to metric system. A list of publications by Verman is given at the end of this biography.

ISI Bulletin

Soon after joining the ISI as its Director, Verman took steps to start a regular periodical of the Institution. The first issue was published in January 1949, and it was a quarterly. Six years later in January 1955, the ISI Bulletin became a bi-monthly and in January 1964, Verman made it a monthly publication. It is an excellent journal dealing with all aspects of standardization.

Standards Engineer

Verman was firmly convinced that Standards is a discipline by itself and advocated the cause of introducing the concept of Standards Engineer. To him, standardization was a "science". A good deal of success of standardization depends, among other things, upon a proper subjective approach. Thus, standardization could not be compared with Physics or Chemistry but it can be termed a "discipline," comprehensive enough in its meaning and inclusive of all branches of science and engineering as well as other forms of knowledge.

In order to encourage standardization in all walks of life, and to create greater awareness of the role of standards in India, Verman created the Institute of Standards Engineers (SEI) with Headquarters in Manak Bhavan. A quarterly journal is being pubished by SEI, informing readers of the valuable contributions ISI is making for India's progress and prosperity.

Verman and the IETE

Dr Verman was a founder member of the Institution of Electronics and Telecommunication Engineers. He became a Council Member in 1957, and remained in the Council more or less continuously, till he passed away. His wisdom, right decisions, help and guidance were invaluable to the Institution. Like ISI, the IETE was another of his passions. He nurtured it with great care in the formative years and saw to it that IETE took its rightful place amongst the professional bodies in the world.

He was President of the Institution for two consecutive terms in 1960–61, and 1961–62. The biographer was the Honorary Secretary during the period. The IETE (then known as ITE) thrived and grew in all directions under his stewardship. The examination system was set on a firm footing; the ITE journal, which was a quarterly at that time, became first a bi-monthly and then a monthly. Membership grew, from 1050 in 1955 to about 3000 in just two years. He laid down the standards for editing, examination and membership. It was at this time that a permanent secretariat for ITE was planned and became a reality in 1963. In meetings chaired by him, all his attention was directed to the growth and improvement of ITE. Although he was a fellow of the Institution of Engineers his first and lasting love was for the ITE. He was responsive to constructive suggestions and disliked useless discussions. All that the Institution has achieved

till today, bears an eloquent testimony to Dr Verman's unfailing guidance, farsightedness, correct decision and abiding love for the cause of the Institution.

Married Life

Verman married an English girl while he was in England during 1933-35. They had two daughters, Kamala and Niki. Both of them are married and are in India. Verman's marriage, however, ended in divorce in 1955. He married again in 1956, and Kunti proved to be an ideal wife and constant companion. She survives Verman. Her hospitality and kindness are a legend.

Post-Retirement Activities

Although Verman retired from the ISI as Director-General on September 2, 1966, he remained associated with it and with other international organisations. Soon after retirement, he became Chief Adviser to the Director-General of the Institute of Standards and Industrial Research of Iran (1966–67). He became UNIDO's Senior Regional Adviser for Industrial Standardization to ECAFE (now ESCAP) at Bangkok during 1967–69. He assisted a number of countries including Afghanistan, Algeria, Iran, Indonesia, Korea, Phillippines, Singapore and Thailand in developing their national standardization programmes.

He also worked as industrial consultant and helped the Government of Algeria in establishing its national standards body (1970). In 1974–75, he led the USAID Project Team for the study of National Standards System of South Korea.

He settled to a well deserved rest after returning from Korea. He was a keen bridge player and enjoyed playing cards in the evenings at the Delhi Gymkhana Club.

It is difficult to portray all the qualities of this great man. His versatility, his passion for standardization, single-minded devotion, deep understanding, resolute handling, farsightedness and creative application will forever be remembered by a grateful nation. In his "passing on" message which he delivered on the eve of his retirement from ISI, he said :

"To my Countrymen, I would like to say : Thank you ever so much for the splendid opportunity for service you gave me, and consider me at your command so long as I live."

And Service to the Country he rendered in ample measure till he breathed his last on October 21, 1979.

S. N. Mitra

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RAM PRASAD MITRA

(1904–1982)

Elected F.N.I. 1953

Birth and Education

Ram Prasad Mitra was born at Chunar, Uttar Pradesh on October 1, 1904. The family hailed from Amta, a village in District Howrah, West Bengal. His father, late Shri Nandagopal Mitra, was a devoted follower of Radha Soami faith. Ram Prasad Mitra had his higher education at Calcutta graduating from the Presidency College (1925) with 1st Class Honours in Chemistry and obtained the M.Sc. (Chemistry) degree of the University of Calcutta from the University College of Science (1928) in 1st Class with a gold medal for securing the first position.

Research Career

In 1933, R. P. Mitra joined Professor J. N. Mukherjee at University College of Science, Calcutta to carry out research work on soil colloids, clay minerals such as bentonites and other natural deposits under a project sponsored by Imperial (now Indian) Council of Agricultural Research. In course of this, he held the Prem Chand Roy Chand Scholarship and was awarded the Mouat Medal of the University for his work on the project. His work on the acid character of hydrogen clays and on the measurements of absolute rates of migration of ions by moving boundary method also earned him the D.Sc. degree (1938) of the University of Calcutta.

Professional Career and Contributions

Mitra worked as an Hony. Lecturer (1941–45) both in Chemistry and in Soil Science for the P. G. classes of the University of Calcutta. During this period, he was also actively associated with the research work of several students of Prof. Mukherjee; mention may be made of N. C. Sengupta (base-exchange in soils and clays), B. Chatterjee (properties of silicic acid soils and displacement of Al^{+s} in H-clays), N. P. Dutta (electrochemical properties of aluminium hydroxide, palmitic, stearic acid hydrosols), S. K. Mukherjee (base-exchange in soils and clays) and S. N. Bagchi (X-ray, thermal and electrochemical properties of clays).

In 1946, Ram Prasad Mitra meft Calcutta to join the University of Delhi as a lecturer but was soon promoted to the position of a Reader. The initial thrust of his research activities at Delhi University centred around :

R. C. Mitra

(a) Electrochemistry of crystals in finely divided state in relation to : (i) some fundamental problems of crystal chemistry, and (ii) electrical and adsorptive properties of colloids, and

(b) Acid character of mica and other plate-like minerals in relation to their structures.

In 1950, Mitra took leave to work with Professor G. I. Finch at the Imperial College of Science and Technology, London on the surface structures of solids by electron diffraction. He had the conviction that the information thus obtained on the surface structure of solids when coupled with that of the electrochemical behaviour would provide valuable information. This was later confirmed by his continued researches in this area.

Ram Prasad Mitra was appointed Professor of Chemistry in the University of Delhi in 1951 and Senior Professor in 1966; the position he held till his retirement in 1970. During his long association with the University of Delhi extending over 25 years he was Head of the Chemistry Department (1966–70) and Dean, Faculty of Science (1966–67). He was also a member of the Court and Executive and Academic Councils of the University, and after his formal retirement in 1970, an Honorary Professor.

Contributions to Chemical Education

Professor Mitra belonged to that rather small select band of enthusiastic University teachers who derive immense pleasure out of teaching and are a source of inspiration to their pupils. During the last 15 years of his association with the University of Delhi, various courses, particularly in Physical Chemistry, both at Honours and P. G. levels, were updated and modernised. He also organised research work in Physical Chemistry section. His interests bore catholicity of out-look and covered such diverse fields as theoretical chemistry, photochemistry etc. Besides the work on various aspects of clay minerals, he initiated research work in the physical chemistry of proteins and polypeptides, kinetics of degradation of polyphosphates, photochemistry of cyanide complexes, and quantum chemistry. This diversity in his research activities indirectly helped the department in as much as the personnel trained in the aforesaid areas later helped in the teaching of these subjects at the P. G. level, and in continuing researches initiated by Professor Mitra. More than 25 of his students were admitted to the Ph.D. degree of the University of Delhi. Some of them now occupy senior academic and professional positions in Universities and institutions in India and abroad. He published 75 original research papers in national and international journals of repute.

Honours

During his association with the University of Delhi, several honours were bestowed upon Professor Mitra. He was elected a Fellow (1951) and was a Member of the Council (1961–62) of Indian National Science Academy. He was Fellow, Member

of the Council (1965–67) and an Hony. Editor (1961–62) of the Indian Chemical Society. He was Hony . Secretary, and a Member of the Council (1944–45) of the Indian Society of Soil Science. He was elected the President of the Chemistry Section of the 49th Session of the Indian Science Congress held at Cuttack. Professor Mitra was nominated a Member of the Executive Committee of National Chemical Laboratory, Pune, Central Salt and Marine Chemical Research Institute, Bhavanagar (1967–69), Central Electrochemical Research Institute, Karaikudi (1964–65) and IIT, Kanpur. He was a Convenor of the Physical Chemistry Section, and Member, Chemical Research Committee of the Council of Scientific and Industrial Research. He was associated as a member of the Indian National Committee for cooperation with the International Union of Pure and Applied Chemistry, (IUPAC).

He organised the I.N.S.A. symposium (1961) on "Electrochemistry" the U.G.C. Summer School (1966) in 'Quantum Chemistry" and the "Convention of Chemists" (1966).

On an invitation from the USSR Academy of Sciences, Professor Mitra visited (1964) the Institutes of Physical Chemistry, Chemical Physics, and of Crystallography, all in Moscow and the Institute of Silicate Research, Leningrad. In 1968, he visited several Universities/Institutions in USA; these included Agricultural Experimental Station, New Haven, Conn., Universities of Illinois, Missouri, Yale, Philadelphia, Chicago, Southern California, Stanford and Berkley, and the California Institute of Technology.

Family

Professor Mitra was greatly liked by his students. On the occasion of his Sixtieth Birth Anniversary, his students and well wishers organised a Symposium on "Electrochemistry", which was attended by the foremost electrochemists of the country. On this occasion, felicitations were received, amongst others, from Professor Linus Pauling (Santa Barbara, California), J.O'M. Bockris (Philadelphia), R. D. Grim (Illinois) and V. I. Spitsyn (Moscow). Also, a "Prof. R. P. Mitra Gold Medal" was instituted which is awarded by the University of Delhi to the student obtaining the highest percentage of marks at the M.Sc. examination in Chemistry.

Married to Bakurani on 17th January 1941, Professor Mitra had a happy family life. As a devoted housewife, Mrs. Mitra helped, encouraged and supported the professor in his various pursuits and administrative responsibilities. The Mitra family was hilarious and a good host. Ram Prasad Mitra was a good critic on art, politics and sports. He enjoyed playing violin.

Last Days

All through his life and almost till his last days, Mitra remained active. After his retirement, he was associated with Radha soami Satsangh, and translated some of their important Hindi publications into English. It was at one of these congregational prayer meetings that he complained of severe pain in the abdominal region

which was later attributed to strangulation of intestines. He was rushed to a nursing home where he breathed his last peacefully on April 12, 1982.

In Professor Mitra's death INSA has lost a distinguished fellow, and the country a reputed scientist and educationist of the highest order.

HARISH C. GAUR

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ATMA RAM

(1908–1983)

Elected F.N.I. 1953

TOWARDS the end of 1942 when Dr Shanti Swarup Bhatnagar, the then Director, Scientific & Industrial Research moved his laboratories from the Government Test House, Alipore, Calcutta, into the newly built premises of Physics and Chemistry Departments of the Delhi University, which were lying vacant at that time, a young scientist aged 34 working in the laboratories of the Director, Scientific & Industrial Research (D. S. I. R.), attracted considerable attention of his colleagues and also visitors, who were at that time plentiful, from various government departments and the defence services. This was Dr Atma Ram who was then a Research Officer with Sir Shanti Swarup Bhatnagar, F. R. S. working on some problems of immediate importance to the defence efforts of the then government. Most of the activities of the laboratories of the D. S. I. R. were to assist the war against the Japanese on the Burma front and South-East Asia, under Lord Mountbatten's overall command. At a period when scientific research was identified with elegant glass apparatus, test tubes and beakers, Dr Atma Ram was handling gallons of some dirty solutions in large drums and buckets in the open courtyard. Not only were the solutions dirty but also smelly. Dr Atma Ram used to be dressed like any technician in 'khaki' half-pants and an ordinary shirt without the usual tie, creaseless shirt and pants. It was but natural that he attracted attention. The problem he was dealing with was the production of air-foam solutions from waste horns and hoofs from animals by degradation and digestion which would form stable foam on aeration. He used to create artificial fires and with a stir-up pump, spray the air foam solutions on the fires to extinguish. To the scientific community then this appeared rather crude compared to elegant scientific experiments on laboratory tables they were used to. But this was a piece of work which was immediately accepted by the Defence services. Similar were his work on moisture detecting compositions, tank seals and the like. These specific problem solving activities which were strictly of immediate relevance to the then needs gave a considerable turn to Dr Atma Ram's thinking and influenced his work in later life. Although he had a D. Sc. degree of Allahabad University in physical chemistry, he became greatly devoted to the application of science to technological problems of industrial and current national relevance.

The manner in which Dr Atma Ram would roll up his sleeves and did not find any work dirty or demeaning so long it was of scientific value and could lead to application, he would not hesitate to do it. In a way it gives an insight into his

life, both his early academic career as well as his later rise in the scientific hierarchy of the country.

Early Life and Educational Career

Born on October 12, 1908 in the tiny village of Pilana in Bijnor district in Western U.P., in a lower middle class family consisting of mostly traders and munshis, Atma Ram had his early education in the village under a village school teacher; he studied Persian, Arabic and Urdu. Coming up to the higher classes he had to walk several miles everyday to a school in another village.

His precocious advancement in the school prompted the family to send young Atma Ram for higher studies to the Banaras Hindu University, where he did his intermediate. He then joined the D. A. V. College in Kanpur wherefrom he passed the B.Sc. degree examination standing first in the college and with merit of the Agra University in 1929. Although the family desired that he should start earning, his teachers at Kanpur and Banaras encouraged him to join the M.Sc. course in Allahabad. He took the M.Sc. degree of Allahabad University in chemistry with first divison and stood first in order of merit. It was with great difficulty that the family could find the necessary finances for his higher education. At one stage, he received a scholarship of Rs. 6/– p.m.!

Based on his performance at his M.Sc. he was taken as a research student by Professor N. R. Dhar, who was then Professor of Chemistry at the University of Allahabad.

Atma Ram worked in the areas of photochemical reaction, photooxidation, presence of formaldehyde and the mechanism of its formation in the upper atmosphere. All these were essentially in pure chemistry and formed the subject matter of his doctorate thesis.

An interesting episode which Dr Atma Ram used to recount often during his later days relates to his visit to a sugar factory during a vacation. One of the technicians incharge of the crystallisation pans had asked him whether he could tell him at what stage the syrup would form crystals. While he was left guessing, the technician demonstrated how by feeling the consistency of the syrup between two fingers, he could exactly say the point at which formation of crystals would set in. This had made a lasting impression on his mind. Throughout his entire career, both as a working scientist and later, as scientist-administrator in the higher echelons of the scientific establishment, he would repeatedly emphasize the importance of technicians in the field of science, technology and industry and the need to recognise their value.

One of the major influences in Atma Ram's life while he was in Allahabad working for his doctorate, was his association with Professor Meghnad Saha who had distinguished himself by his fundamental contributions to astrophysics, and who was then Professor of Physics in Allahabad University. Among the many intellectual friends of Pt. Jawaharlal Nehru, Professor Saha was at that time held in great esteem by Nehru. Saha had developed a particular liking for Atma Ram for his

devotion to scientific work and his basic thought processes. At the instance of Professor Saha, Atma Ram did certain amount of background work for the National Planning Committee under Nehru's Chairmanship and thus came into contact with Nehru who also considerably influenced him.

Entry into Industrial Research

This event could also be considered as one which prompted Dr Atma Ram to seek a position in the Industrial Research Bureau then functioning in the Government Test House in Alipore, Calcutta. The Bureau was a small set-up and at that time the available openings for young men with science qualifications were also very few, and therefore, there was stiff competition even for a very junior position. He was interviewed by a high-power Board. He got selected to the post. Later, when the Industrial Research Bureau was taken over by the newly appointed Director of Scienctific and industrial Research, Dr Sir Shanti Swarup Bhatnagar, F. R. S., Dr Atma Ram became one of the nucleus staff of the organisation which blossomed forth as the present Council of Scientific and Industrial Research and its chain of National Laboratories.

Since the total number of scientists working in the laboratories of the D. S. I. R. was small, Dr Bhatnagar kept in close touch with each individual by assigning projects and watching and monitoring their progress day-to-day. He would personally go round and discuss with each scientist. Dr Atma Ram impressed him a great deal. The entire programme of D. S. I. R. was organised on the basis of projects only and almost all of them related to the immediate needs of the then situation. In the early period, relevance was considered in terms of the war effort. But as the war was coming to a close Dr Bhatnagar nurtured other ideas, more long-term in nature in the national perspective. Projects were taken up and financed by individual departments of the then government. Dr Bhatnagar would canvass for such projects from the departments. He prepared the basic concept and outlines for setting up a chain of national laboratories for which he did not hesitate to bring influence and pressure, if one may say so, through his scientist friends and colleagues in the U.K., as for instance Professor A. V. Hill, F. R. S., who visited India and submitted a report to Government.

Dr Bhatnagar also got appointed a Committee under the chairmanship of Sir R. K. Shanmugam Chetty (who later became the first Finance Minister of free India) to examine the necessity, the directions and details of future industrial research in India. This Committee recommended the setting up of a number of industrial research laboratories, some discipline-wise and some industry-wise. Most part of subsequent activity of Dr Bhatnagar was devoted to the planning and establishment of a chain of national laboratories amongst which was the Central Glass & Ceramic Research Institute.

One of the methods adopted by Dr Bhatnagar was the constitution of a number of Research Committees for specialized areas of science and entrusting them with the functions of promoting, sponsoring and funding of research schemes and also preparing futuristic plans for specialised areas. By this means he was able to bring

within the domain of governmental funding of research a large number of professors and experts in universities and other academic institutions. Similarly, Dr Bhatnagar constituted Committees on which he drafted top experts in the academic institutions, government departments and industry to prepare the basic plan, structure and functions of each one of the national laboratories and central research institutes. While the membership of such committees was honorary, there was a Secretary either on full-time basis or one of his research officers was assigned on part-time basis to do the secretarial and detailed work for the committees. Dr Atma Ram was associated with such a committee in the field of glass and ceramic technology. It was obvious that Dr Bhatnagar felt that with Dr Atma Ram's academic background as a physical chemist and his subsequent interest and success in technological research relating to industrial problems he would be the most appropriate person.

Glass and Ceramics Research

When the Government of India took the decision to set up the Central Glass and Ceramic Research Institute, the obvious choice for Dr Bhatnagar was to request Dr Atma Ram to do its planning and take charge of the establishment of this Institute in Calcutta from the scratch. From 1945 to 1949, Dr Atma Ram's efforts were entirely devoted to the datailed planning, construction, equipping and manning of the Institute right from acquisition of a piece of land at Calcutta. The tremendous boost that science and technology got in the hands of Nehru from 15th August 1947 onwards is well known. He took over the Presidentship of C. S. I. R. and the establishment of the laboratories was done with great expedition. Dr Atma Ram was asked to take over as Joint Director of the Institute between May 1949 to January 1952 and Director from January 1952 onwards. In this capacity he was instrumental to formulating research programmes and progressing them. The manner in which he did this earned him encomiums of both the academic community and industry.

Another important event in Dr Atma Ram's life which may be mentioned as of some significance was his inclusion as a member of one of the investigating teams to visit Germany at the conclusion of the War. As Germany was under military occupation Dr Atma Ram was given the honorary rank of Colonel and put on uniform. The visit was organised by the Allied Control Commission to laboratories and factories in the field of glass and ceramics and related areas. During this visit a sharpnel struck one of his eyes and he had to be hospitalized both in Europe and in England for a number of months at the end of which he lost one of his eyes and for the rest of his life he worked with only one eye. Medical treatment at that time was still not as advanced as at present with the result he developed allergy to most chemotherapeutic drugs as well as antibiotics. He contracted a bronchial problem, asthma and urticaria from which he frequently suffered afterwards. Ultimately, he succumbed to bronchial infection. Because of this allergy, he had to avoid antibiotics and other modern remedies and substitute them with homeopathic treatment whenever he fell ill. His long stay in Calcutta helped him to acquire a certain amount of mastery in homeopathic medicine and practice. He became extra

conscious about his food and living habits; he was a strict vegetarian, nonsmoker and teetotaller. Because of this regimen he was somewhat withdrawn in his social habits.

As Director of the Central Glass and Ceramic Research Institute (C. G. & C. R. I.) by the manner in which he went about organising its activities, he was able to bring in industry's cooperation and involvement right from the beginning. At the early stages when the Indian glass and ceramic industry was still at a rudimentary level, the two major projects which secured for the Institute the confidence of the industry were the comprehensive all-India survey of glass and ceramic raw materials, their availability both quantitatively and qualitatively, their beneficiation and treatment for use in industry. This survey established hitherto unknown sources of high grade raw materials within the country which could be used in place of imported ones. The second project was detailed testing of the products manufactured and marketed by the industry. During the testing of samples procured from the market he invited representatives of manufacturing companies to witness it and offer suggestions. With the aid of such tests he was able to deduce the basic defects in the manufacture of these products and show the industry how these could be rectified. Having once established a rapport with industry he could take further steps to develop new products out of waste, improvements in existing production techniques and substitution of imported raw materials. One of the important ones that could be mentioned is the substitution of imported selenium with copper to produce the ruby red glass which was one of the most popular items of bangle making industry of Ferozabad. This investigation he carried out not only in the laboratories but also right in the factories of Ferozabad. From waste mica, a byproduct of the Bihar mica industry, he developed new products such as mica-based paints, reconstituted mica, mica insulating bricks and the like. From glass waste, he developed a new product foam glass, which was very light in weight and heat insulating. Quite a number of these developments were put into commercial use. Among other products could be mentioned chemical procelain, railway signal glasses, special refractories, glass electrodes for *p*H meters and spark plugs. He had taken about 23 patents relating to all this work and many scientific papers and technological reports and communications.

Optical Glass

However, the most outstanding work by Dr Atma Ram at the CG&CRI which attracted attention, both within the country and outside, was the establishment of the technology and production of optical glass in the country. He had occasion to visit the National Bureau of Standards, U. S. A. where some work on optical glass was going on. Although he was denied access to the crucial operations in the making of optical glass, he made full use of his stay to absorb mentally as much information as possible. He had also visited many European countries, visiting glass factories and ceramic factories, and he could absorb and develop many new ideas. The Government of India was keen in estabishing an optical glass plant and all the negotiations to obtain the knowhow did not fructify. Ultimately, the Government

of USSR agreed to set up an optical glass unit as part of their Ophthalmic Glass Project at Durgapur. During this period, Dr Atma Ram was quietly working on his project, created the infrastructure necessary including the equipment and instrumentation needed for production of optical glass and announced proudly that requirements of the country's optical glass could be fully met by his small unit at CGCRI. He had a most receptive Prime Minister at that time in Jawaharlal Nehru whom he met and showed some of the samples and convinced him that there was no necessity for any foreign technology. The matter was taken up at the highest level between the Government of India and the Government of USSR and the optical glass part of the Project in Durgapur was deleted. Since then most part of India's requirements of optical glass of international standards is made at the CG & CRI, Calcutta.

While the above project could be cited as an example of Dr Atma Ram's technological triumph, on the pure scientific side his research and publications in regard to the role of cuprous ion in providing the ruby red colour in glass altered the then prevailing concept. His another important contribution is the production of highly homogeneous, optically clear and corrosion resistant lead glass sheets, blocks and slabs, for nuclear reactors. His work at CG & CRI earned for him the reputation of being a capable organiser of industrial research and one who introduced into industry a certain amount of scientific consciousness and, vice versa, among the scientific community the essential element of commercial sense without which industrial research could not succeed.

A perusal of the list of patents and research papers, both scientific and technological, given at the end of this Memoir, will show the wide canvas of Dr Atma Ram's interests and work in the field of glass, ceramics and mica industries. His record at Calcutta drew high appreciation from the Reviewing Committee Consisting of Sir Alfred Egerton, F.R.S., and later Sir Ramaswami Mudaliar, Professor W. E. S. Turner, F.R.S., of Sheffield, a doyen in the field of glass and ceramics technology who went to the extent of publishing a note of appreciation in the British Journal of Glass and Technology in the following words :

All glass technologists can feel a glow of pleasure at the prominent place their subject has attained in India and will join in their appreciation of Dr Atma Ram's work.

Honours

Directly flowing from his performance in Calcutta, he was the recipient of some high honours. He was awarded the *Shanti Swarup Bhatnagar Medal* of the Indian National Science Academy in 1959 for outstanding contribution in physical and technological sciences. In 1964, the All-India Glass Manufacturers Federation honoured him with a plaque of honour for bringing science consciousness in the glass industry. The International Commission on Glass made him special Member under the special category of outstanding merit. In 1966, he was made an Honorary Fellow of the world famous Society of Glass Technology, Sheffield. In 1967, the Indian Ceramic Society honoured him for his outstanding contributions for science

and technology. In the same year, the degree of Doctor of Technology, *honoris causa,* of the Lenin Soviet Technological Institute of Leningrad was bestowed upon him.

He was elected to two of the high offices in the community of scientists, namely, Presidentship of the Indian Science Congress (1968) and that of the Indian National Science Academy (1969–70). These two positions gave him the platforms and bestowed upon him a certain amount of scientific independence to express his views as he felt. He was also President of the Institution of Chemists and the Indian Ceramic Society which were more professional in character.

Dr Atma Ram was also invited by a number of universities to deliver their convocation addresses and scientific institutions to preside over or inaugurate functions. The Universities of Banaras, Saugar and Andhra honoured him with honorary doctorate degrees. These occasions also gave him opportunities to speak out his mind on many current issues.

One of the honours which Dr Atma Ram valued a great deal was the recognition by the "Anuvrat Movement" of the Jaya Tulsi Foundation. His distinguished and long service to the cause of ethical principles and moral and human values and character building were recognised in a function of the above foundation in October 1981 and he was given a cash award of rupees one lakh. Dr Atma Ram's steadfastness to principles is amply borne out by the fact that he at once contributed the award back to the Anuvrat Movement to be used for the good cause they were working for.

As Director-General, CSIR

The Government of India invited him to fill in the vacancy of Director-General of Scientific and Industrial Research in August 1966. His period as Director-General of Council of Scientific and Industrial Research could be considered in many ways 'tumultous'. He was not afraid of giving certain new orientations in the functioning of the organisation which he felt were necessary. In the process, he set in motion a certain amount of contentions and reactions for and against, in the scientific community, in the press, parliament and even at the political level. It should be said to his credit he could face the resultant problems courageously and with determination. Although he could be considered as a member of the establishment, he did not hesitate to express independent views sometimes to the discomfiture of the establishment. He considered it as a basic privilege of a scientist to express objectively his views without the constraints of office.

He had the courage of his convictions to discuss frankly, freely and fearlessly although some people felt he was creating controversies. His view was that leaders of science and technology in the country should discuss and debate, provoke and initiate such debates on major policy questions in the field of organisation and management of science and technology, the role of scientists in society in India, content and policies of education, science and technology in the development process of the country, the rights and responsibilities of scientists, the need for a separate Technology Policy Statement, policies governing technology trade with other countries

etc. Many of his utterances were provocative leading to widespread debates, discussions and sometimes adverse reactions and even personal accusations of Dr Atma Ram by a few. But till the last days nothing deterred him from straightforward and forthright expression of his views. His personality and statements attracted not only the scientific community at large but also the media, particularly the newspapers, parliament and the political leaders. He had his supporters, both inside and outside the country, as well as those who questioned his views. He welcomed such discussions and debates so long as they were healthy. He continued to be ebullient.

Some Important View Points

Restriction of space does not permit detailed analysis of this particular aspect of Dr Atma Ram's career. Nevertheless, some of the more important utterances and views of Dr Atma Ram may be listed briefly without discussing the merits and demerits of any of them. It is, however, important to note that he did not exercise any dichotomy in his precepts and practice. He tried his best to put into function many of his ideas although he did not always succeed:

1. A society which continued to be largely illiterate, would find progress, economically, socially and culturally at a fast rate difficult. Therefore, first priority must be given to education not only for imparting knowledge but also skills.
2. The superstructure of Indian science and technology to be strong, healthy and progressive, must be built on the strong foundations of university research. This was not given enough attention.
3. The academic community, particularly scientists and technologists, have a tremendous social responsibility in India. This means their activities should be related to needs of the society which supports them.
4. Freedom and accountability must go hand in hand in the work of scientists. Freedom cannot be interpreted to mean that one can do whatever one wishes to, but one should have the fullest intellectual freedom to carry out one's tasks, in the choice of which national requirements should dictate; the methodology of dealing with a project should be entirely that of the scientist.
5. In a poor country like India scientists must be extra careful in spending public funds.
6. Scientists who continued to work at the bench were far more important than those who had gone into offices to deal with paper work, administration or similar responsibilities. While the role of a technician should be appreciated and he should be given the best possible terms of emoluments and recognised in society, the relative roles and functions of a scientist and a technician should be understood. It may not be good to call a technician, a scientist.
7. There had been increasing governmentalisation of Indian Science with the result there was no independent scientific public opinion in the country which could critically examine, comment and even question government policies and functioning in the field of science and technology.

8. Scientific academies and learned societies have a special responsibility for generating independent scientific public opinion. He felt that this had not happened to the extent necessary.
9. While science and technology interact synergistically they had their own separate identity, roles and importance, As India had one of the best statements on Science Policy, there ought to be a Technology Policy Statement as well. After a number of years of campaigning by him, the government did make a Statement on Technology Policy.
10. For several reasons he wanted a more liberal policy of import of technologies from the advanced countries subject to certain basic conditions such as adaptation and further improvements within the country, selectivity with a view to encouraging indigenous efforts (without providing protection to mediocre efforts). He felt that although people felt rather strongly against imports of technology, the fact was that more than 90% of technological knowhow and industrial development in India had been based on such imports, although often times, indiscriminate. Even the public sector had been built more or less completely with imported technology. Whatever indigenous efforts had been made in the private sector had been built upon the efforts of scientists, engineers and technicians throughout the country, on the basis of adapatation and improvements of imported plant and machinery and equipment and technology. He, therefore, felt his views were completely justified. He even felt inspite of all that was being said, it was likely our dependence could continue for quite sometime because of the inadequacy of our efforts within the country.

Dr Atma Ram was appointed Chairman of the National Committee on Science and Technology (N.C.S.T.) in June 1977. In this position, he had the national responsibility of overseeing the total science and technology effort in the country. As Chairman of N. C. S. T., he was Principal Advisor to the Prime Minister and the Union Cabinet on Science and Technology and, therefore, as soon as the Government at the Centre fell, he submitted his resignation without any loss of time in order that the new Prime Minister may have the opportunity to review such appointments. He considered that this was a matter of principle and he should set up a healthy precedence.

The three most important questions dealt with by the N.C.S.T. under his guidance were :—

(a) Science and technology education must get a fair share of the brightest young.
(b) The need to substantially augment the resources of the universities for research and development.
(c) Preparation of the draft of the Technology Policy Statement for Government's consideration.

Dr Atma Ram, even after ceasing his connection with the government continued to take active interest in the field of science and technology as an adviser to scientific foundations and industrial groups for the establishment of their corporate R & D

and also in matters of science policies. Till the day of his demise his interest in science and technology was spirited and lively.

It may not be known to many that an event occurred in his official career to show what a man of principle he was. When he was appointed in August 1968 as Director-General of Scientific and Industrial Research with the position of Secretary to the Government of India, for a period of about 10 months he declined to draw the salary as the appropriate orders regading his Secretaryship and the terms going with it were not issued because of some behind the scene happenings. Dr Atma Ram felt that if he compromised in any manner in regard to the D.G.'s position, it may be harmful not only to his functioning but to the status of the post itself in future and this would do damage to the cause of science and technology in India. Ultimately, he had his way and in the process he vindicated again a principle. These and other episodes mentioned in this memoir and many not mentioned here go to establish his unswerving devotion to principles, values and causes he held dear and he felt convinced to be correct.

K. G. KRISHNAMURTHI

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